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VOLUME 19, NUMBER 11
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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
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The Secretary of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1987.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

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Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

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03 WATER SUPPLY AUGMENTATION AND CONSERVATION

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04 WATER QUANTITY MANAGEMENT AND CONTROL

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SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

NEW METHOD FOR OBTAINING A SPATIALLY AVERAGED INFILTRATION RATE FROM RAINFALL AND RUNOFF RATES,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
For primary bibliographic entry see Field 2G.
W86-05074

EFFECT OF QINGHAI-TIBET PLATEAU FORCING ON THE MESO-SCALE RAIN-BEARING CIRCULATION SYSTEMS OVER EASTERN CHINA DURING PRESUMMER RAINY SEASON,
European Centre for Medium Range Weather Forecasts, Reading (England).
For primary bibliographic entry see Field 2B.
W86-05090

APPROACH FOR FREQUENCY ANALYSIS OF MULTIYEAR DROUGHT DURATIONS,
Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering.
K. S. Lee, J. Sadeghipour, and J. A. Dracup.
Water Resources Research WRERAO, Vol. 22, No. 5, p 655-662, May 1986. 7 fig, 3 tab, 20 ref. NSF Grant No. 77-1137 and University of California Water Resources Center Grant W-615.

Descriptors: *Frequency analysis, *Drought, Streamflow, Water supply profiles, Mathematical analysis, Water shortage, Probabilistic process, Model studies, Feather River, California.

A practical approach is developed for the frequency analysis of multiyear drought durations of annual streamflow series. The proposed approach utilizes a technique which smooths the frequency-curve irregularity of drought durations, which then reduces the statistical uncertainties associated with sample-size limitations. Several hazard-function models are examined with regard to their ability to represent the duration-dependent termination rate of a drought data set. The logistic model with an exponential correction for short durations is considered to have sufficient flexibility for describing most portions of the termination-rate function. The parameters of the logistic model are identified using a piecewise linear regression for the linearized termination probability curve. Once the form of the hazard model is specified and its parameters are estimated, the probability distribution and exceedance probability of drought durations can be determined from their corresponding relationships with the hazard model. The historic droughts of Feather River, California, are used to demonstrate the methodology. Results indicate that the observed nine-year drought of Feather River has a return period of 360 years. (Lantz-PTT)
W86-05212

DISPERSION IN FRACTAL FRACTURE NETWORKS,
Disposal Safety, Inc., Washington, DC.
For primary bibliographic entry see Field 5B.
W86-05230

STATISTICAL INFERENCE OF SPATIAL RANDOM FUNCTIONS,
Hebrew Univ. of Jerusalem (Israel). Dept. of Agricultural Economics.
E. Feinerman, G. Dagan, and E. Bresler.
Water Resources Research WRERAO, Vol. 22, No. 6, p 935-942, June 1986. 5 fig, 15 ref.

Descriptors: *Statistical analysis, *Statistical hydrology, *Spatial random functions, *Flow profiles, Mathematical studies, Probabilistic process, Analysis of variance.

A methodology to infer the spatial distribution of the statistical moments of a stationary normal random spatial function based on a finite set of measured values is described. The uncertainty of estimation of the parameters characterizing the probability density function (pdf) is incorporated in the process of inferring and conditioning. Relationships generalizing the traditional approach of stochastic interpolation and simulation have been derived. They yield: 1) an estimate of the conditional expectation; 2) an estimate of the conditional multivariate normal (MVN) covariance and variance; and 3) a new quantity, the variance of the estimated variance. The method is illustrated for a two-dimensional synthetic example with both estimated mean and variance regarded as random. A set of 60 points was generated within a square of sides equal to unity from a MVN population with zero mean, unity variance and exponential covariance with a linear integral scale of 0.3. Contour maps of the inferred expected values and variances were drawn and compared with maps of kriged values and maps of kriged variances. The unconditional and conditional statistical moments of the space average (block value), z', were also evaluated. The reduction of the uncertainty of the inferred random variable z' as the number of measured points increases is demonstrated with the same synthetic example. (Lantz-PTT)
W86-05254

UPDATED CLIMATE FEEDBACK DIAGRAM,
Maryland Univ., College Park. Dept. of Meteorology.
For primary bibliographic entry see Field 2B.
W86-05314

2B. Precipitation

DETERMINATION OF THE PARAMETERS OF WATER INTAKE BY SOIL WITH THE ENERGY CHARACTERISTICS OF RAIN TAKEN INTO ACCOUNT,
Moscow Inst. of Agricultural Engineers (USSR).
For primary bibliographic entry see Field 2G.
W86-04732

STUDY OF THE DYNAMICS OF DROP EROSION UNDER LABORATORY CONDITIONS,
Lajos Kossuth Univ., Debrecen (Hungary).
For primary bibliographic entry see Field 2J.
W86-04879

INSTRUMENTATION FOR STUDIES OF THE EROSIVE POWER OF RAINFALL,
National Coll. of Agricultural Engineering, Silsoe (England).
For primary bibliographic entry see Field 7B.
W86-04881

ACID RAIN IN WESTERN EUROPE AND NORTHEASTERN UNITED STATES - A TECHNICAL APPRAISAL,
Ford Motor Co., Dearborn, MI. Chemistry Dept.
For primary bibliographic entry see Field 5B.
W86-05039

RAINFALL INVESTIGATIONS AT CARDINGTON AND WINCHCOMBE 1954-67,
British Meteorological Office, Bracknell (England).
R. P. W. Lewis.
Meteorological Magazine, Vol. 115, No. 1364, p 86-94, March 1986. 2 fig, 9 ref.

Descriptors: *Rainfall, *Cardington, *Winchcombe, Open scale strip chart, Tilting siphon, Rainfall intensity, Rain gages, Urban runoff, Storm sewers, Weather data collections, Data acquisitions.

An account is given of the setting up and operation of two investigations carried out by the Meteorological Office into the fine-scale structure in space and time of heavy downfalls of rain using networks of synchronized open-scale rain recorders, one in flat and one in hilly country during the period 1954 to 1967. The work was planned and coordinated by the Joint Committee on Rainfall and Run-off (JCRR). One investigation was near Cardington in Bedfordshire, and the other near Winchcombe in the Cotswolds. The Instrument Development Branch at Harrow devised an open scale chart mechanism which could be attached to the normal Meteorological Office tilting siphon (T/S) rain recorder in place of the daily drum. While the Winchcombe investigation was in progress, the one at Cardington ran its course and the network there was closed down in June 1963. Data from about 150 storms was collected. Considerable care was taken to allow for losses in catch during the siphoning process, an important matter for intense falls of rain. Much attention was also given to the relative efficiency of catch of the various gauges by comparing long term totals, and to the elimination, as far as possible, of the inevitable errors of synchronization introduced into the records by the way in which the strip charts tended to jump sprockets, or slip, or pull alternately too taut and too loose. The data have been used in design studies for storm water sewers (Department of the Environment 1976) and for the pattern of urban runoff. (Peters-PTT)
W86-05045

YES, PRECIPITATION FORECASTS HAVE IMPROVED,
National Weather Service, Silver Spring, MD. Techniques Development Lab.
H. R. Glahn.
Bulletin of the American Meteorological Society, Vol. 66, No. 7, p 820-830, July 1985. 6 fig, 4 tab, 22 ref.

Descriptors: *Weather forecasting, *Precipitation forecasting, Probable maximum precipitation, Rainfall, Forecasting.

A 1982 analysis of published verification scores of National Weather Service (NWS) forecasts of measurable precipitation concluded that except in winter in the eastern and central regions, any increase in accuracy from 1966 to 1978 was negligible, with improvement even harder to achieve in summer. A study was undertaken to gain a better understanding of these conclusions and to see whether they would hold over a longer period of record. The study was based on 11 of the 12 years used in the 1982 study and 4 additional years. The scores used are percent correct and skill score. There is strong evidence that probability of precipitation forecasts have improved over the 15-year period from 1967 to 1982. The main reason for improvement in precipitation forecasting over the 1967-81 period is the improvement of numerical-weather-prediction (NWP) models. Contributing factors may be improved interpretation of the NWP models through statistical and subjective procedures and the more timely delivery of the NWP products and statistical guidance to field forecasters. (Khumbatta - PTT)
W86-05070

EFFECT OF QINGHAI-TIBET PLATEAU FORCING ON THE MESO-SCALE RAIN-BEARING CIRCULATION SYSTEMS OVER EASTERN CHINA DURING PRESUMMER RAINY SEASON,
European Centre for Medium Range Weather Forecasts, Reading (England).
S. Chen, and L. Dell'Osso.
Journal of the Meteorological Society of Japan, Vol. 64, No. 1, p 53-63, February 1986. 8 fig, 14 ref.

Descriptors: *Rainfall, *China, *Atmospheric physics, *Weather forecasting, Qinghai-Tibet plateau, Meso-scale system, Orography, Monsoons, Model studies.

The low level jet and the associated low level south-west vortex are the main mesoscale systems which bring heavy rains over East Asia. The influence of Qinghai-Tibet Plateau (QTP) on these circulation systems was examined using the ECMWF grid point limited area model for a typical heavy rainfall case during the presummer rainy (Mei-yu) season. A control experiment, in which the orography represents the mean value over a grid box, reproduced the variation of the low level jet, the

formation of the south-west vortex and the heavy rainfall area. When the height of QTP is halved, the south-west monsoon south of the Plateau interacts with the middle latitude westerlies. A baroclinic then develops instead of the meso-scale systems, and the heavy rainfall zone is shifted to the east. Increasing the QTP height causes the meso-scale systems to be enhanced and restricted to the vicinity of the Plateau, and the rainfall zone is shifted to the west. In an experiment with an envelope orography, the south-west monsoon flow travels round the Plateau. With the westward shift of the Western Pacific Subtropical High (WPSH), the Low Level Jet (LLJ) becomes a southerly flow parallel to the east flank of the Plateau. The south-west vortex is not well formed and no Mei-yu cyclone appears over the Yangtze Valley. The heavy rainfall restricted to the Sichuan Basin suggests that no typical Mai-yu occurs. The formation and maintenance of the LLJ is mainly due to the southern boundary effect to the south-west monsoon. The Plateau restricts the interaction between westerlies and south-west monsoon which is essential for the vortex genesis over the Plateau and the consequent evolution of the rain bearing systems east of the Plateau. Enhancing the interaction or reducing the interaction causes a dramatic change of the Mai-yu circulation. WTP forcing has a significant effect on the heavy rainfall regime over eastern China. Precipitation areas are shifted to the northeast when the Plateau height is reduced and to the southwest when the height is increased. (Peters-PTT)
W86-05090

TWO-WAVELENGTH (0.86 CM AND 3.2 CM) RADAR OBSERVATION OF MICROPHYSICAL PROCESS IN STRATIFORM PRECIPITATION PART I. ATTENUATION OF RADAR WAVE DUE TO PRECIPITATION PARTICLES AND CORRECTION METHOD,
Nagoya Univ. (Japan). Water Research Inst.
T. Yokoyama.
Journal of the Meteorlogical Society of Japan, Vol. 63, No. 6, p 1097-1108, December 1985. 1 tab, 6 fig, 18 ref.

Descriptors: *Precipitation, *Radar, *Rain, *Snow, Precipitation rate, Atmospheric physics, Model studies, Rainfall intensity.

The attenuation of K-, X- (3.2 cm) and C-band (5.6 cm) waves was calculated based on a model of precipitation, for three precipitation intensities, i.e., heavy (32 mm/hr), ordinate (4 mm/hr) and weak (0.5 mm/hr) precipitations. The attenuation coefficient is larger in the melting layer by one or two orders than in the lower raindrop region. The effect of the size distribution on the attenuation abruptly increases as the attenuation is enhanced. The attenuation of X- and C-band waves are small enough to be neglected except for heavy precipitation. In the case of heavy precipitation, K-band wave is severely attenuated, especially in the melting layer, so that the signals cannot be detected by the radar receiver. In the cases of ordinary and weak precipitations, true radar reflectivity factors of the K-band wave can be obtained by corrections of the attenuation. A correction method using the radar reflectivity factor of the X-band radar was investigated. After the correction, precipitations weaker than about 4 to 7 mm/hr can be safely observed within an error of 2dB by the two wavelength radar technique using K- and X-band radars in the raindrop region. In the melting layer, the correction method can be used without a large error when the precipitation is weaker than 2 to 4 mm/hr. (Peters-PTT)
W86-05091

TWO-WAVELENGTH (0.86 CM AND 3.2 CM) RADAR OBSERVATION OF MICROPHYSICAL PROCESS IN STRATIFORM PRECIPITATION PART II. STUDY ON SIZE DISTRIBUTION CHANGE OF PRECIPITATION PARTICLES,
Nagoya Univ. (Japan). Water Research Inst.
T. Yokoyama, and Y. Ishizaka.
Journal of the Meteorological Society of Japan, Vol. 63, No. 6, p 1109-1126, December 1985. 1 tab, 10 fig, 21 ref.

Descriptors: *Precipitation, *Radar, *Rain, *Snow, Precipitation rate, Model studies, Atmospheric studies, Rainfall intensity.

Whether the size distribution change due to coalescence or breakup of melting snowflakes and raindrops occur significantly in the lower half region of the melting layer and the raindrop region was investigated by two wavelength radar observations together with model calculations. The response of the radar reflectivity factor to size distribution transition between two altitudes is dependent on the radar wavelength. Two radars with wavelength of 3.2 cm (X-band) and 0.86 cm (K-band) were used. The two wavelengths gave significantly different radar reflectivity factors. Comparison of the observed and calculated results gives strong evidence for particle size distribution transition equivalent to coalescence in the lower half region of the melting layer for stably uniform precipitations. The activity of the distribution transition does not depend on the precipitation intensity. For the same type of the precipitation, when the precipitation rate is relatively large, increase of medium sized particles (0.1 to 0.25 cm in diameter) is likely to be predominant in the raindrop region just below the melting layer. (Peters-PTT)
W86-05092

EXPERIMENTS ON AEROSOL SCAVENGING BY NATURAL SNOW CRYSTALS PART III. THE EFFECT OF SNOW CRYSTAL CHARGE ON COLLECTION EFFICIENCY,
Hokkaido Univ., Sapporo (Japan). Graduate School of Environmental Science.
For primary bibliographic entry see Field 2C.
W86-05093

NEW TECHNIQUE FOR MONITORING THE WATER VAPOR IN THE ATMOSPHERE,
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
H. D. Black, and A. Eisner.
Journal of Geophysical Research, Vol. 91, No. C2, p 2331-2337, February 15, 1986. 2 tab, 2 fig, 16 ref.

Descriptors: *Water vapor, *Precipitation, *Satellite technology, *Atmosphere, Doppler data, Tropospheric effects, Refraction integral, Atmospheric water, Mathematical studies.

A technique for obtaining realistic values of precipitable water vapor (PWV) is discussed. In correcting satellite doppler data for tropospheric effects, it has been found that the PWV can be inferred at the tracking site. The determination proceeds via a least squares fit of a refraction parameter, along with several others, to each 15-minute pass of data. For its success the technique depends on having an ephemeris for the satellite, an analytic model for the refraction range effect that is good to a few centimeters, doppler (range difference or cycle count) data with a noise level below 10 cm, and a surface pressure/temperature measurement at the tracking site. The PWV is a byproduct of the computation necessary to correct the doppler data for tropospheric effects. Attempts to reliably isolate the tropospheric refractive effect in the doppler shift measurement were successful recently due to a formulation of the refraction integral that minimizes the necessity for explicit water vapor, temperature, and pressure profiles. (Peters-PTT)
W86-05097

ACHIEVING IMPROVED FREQUENCY RESPONSE OF THE RAIN STRUCTURE FROM SPACEBORNE RADAR ALTIMETERS BY EMPLOYING DECONVOLUTION METHODS,
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
J. Goldhirsh, and F. M. Monaldo.
Journal of Geophysical Research, Vol. 91, No. C2, p 2338-2344, February 15, 1986. 5 fig, 14 ref.

Descriptors: *Radar, *Rain, *Reflectance, *Satellite technology, Rain structure, Deconvolution methods, Frequency response, Virginia, Wallops Island, Data interpretation, Fourier analysis, Mathematical studies, Altimeters.

A technique is described for arriving at improved measurements of the rain structure near the earth's surface from satellite-borne radars. By combining the beam-averaged reflectivity profile and the beam pattern information, a resultant structure is obtained which contains improved spectral content compared to that of the beam-averaged structure. The method uses deconvolution and Fourier transform procedures and assumes a knowledge of the antenna beam pattern. As an example, the method is directed toward the application of future spaceborne radar altimeters that may contain additional range gates to permit the measurement of rain in the lower troposphere. Using a radar-measured rain reflectivity profile acquired at Wallops Island, VA, in a simulation example, it is demonstrated that improved measurements of the spatial frequency spectrum of the rain structure may be deduced by means of deconvolution methods, as compared to the measured spectrum derived by beam averaging. Rain measurements are considered vital from the standpoint of providing a flag for altimeter data that may be corrupted by rain over the oceans where few or no such data are available for the meteorologist or the communicator interested in space diversity communications. (Peters-PTT)
W86-05098

ACCURACY OF RAINFALL ESTIMATES BY RADAR, PART I: CALIBRATION BY TELEMETERING RAINGAUGES,
British Meteorological Office, Easthampstead (England). Operational Instrumentation Branch.
C. G. Collier.
Journal of Hydrology, Vol. 83, No. 3/4, p 207-223, March 1986. 3 tab, 6 fig, 10 ref.

Descriptors: *Rainfall, *Radar, *Raingages, Estimates, Telemetry, Rainfall rate, England, Data interpretation.

The accuracy of the estimates of hourly rainfall derived from both calibrated and uncalibrated C-band (5.6 cm wavelength) radar located in north-west England has been assessed. Calibrated radar data are provided in real time to both meterological and hydrological users. The accuracy of these data, assessed by comparison with raingage measurements, is comparable to the accuracy attained in the Dee Weather Radar Project. The calibration procedure improves the overall accuracy of the uncalibrated data within about 75 km of the radar site in frontal rainfall even when bright band effects are present. In convective rainfall, calibration has on average a smaller affect, although it may have a large effect on individual cases. Problems encountered with the real time operation of the raingage calibration procedure include: (1) calibration gage interrogation failures due to failures in communication links or broken gages; (2) fluctuations in rainfall type, and (3) application of inappropriate calibration factors. (Peters-PTT)
W86-05109

ACCURACY OF RAINFALL ESTIMATES BY RADAR, PART II: COMPARISON WITH RAINGAUGE NETWORK,
British Meteorological Office, Easthampstead (England). Operational Instrumentation Branch.
C. G. Collier.
Journal of Hydrology, Vol. 83, No. 3/4, p 225-235, March 1986. 1 tab, 4 fig, 14 ref.

Descriptors: *Rainfall, *Radar, *Rain gages, Telemetry, Rainfall rate, England, Flood forecasting.

The measurement of hourly point rainfall by a sparse telemetering raingage network was investigated. Radar was used to estimate rainfall within a real time flood forecasting system, which also acquires rainfall information from a number of telemetering raingages over and above those used to calibrate the radar. The bias and random errors in hourly point rainfall totals derived from the telemetering gage network alone, and from the radar, calibrated using data from only a few gages, are compared. The best method of real time rainfall measurement for use with the flood forecasting system was assessed. The most appropriate method of measurement depends upon the rainfall type; the calibrated radar estimates are more accurate within

75 km of the radar site than those using the telemetering raingage network alone. (Peters-PTT)
W86-05110

ACCURACY IN RAINFALL ESTIMATES BY RADAR, PART III: APPLICATION FOR SHORT-TERM FLOOD FORECASTING,
British Meteorological Office, Easthampstead (England). Operational Instrumentation Branch.
C. G. Collier, and J. M. Knowles.
Journal of Hydrology, Vol. 83, No. 3/4, p 237-249, March 1986. 6 fig, 23 ref.

Descriptors: *Rainfall, *Radar, *Rain gages, *Flood forecasting, Telemetry, Rainfall rate, England, Hydrologic models, River flow, Hydrographs, Thunderstorms, Rainfall intensity.

Simulations of river flow using a simple hydrological model and the sensitivity of the simulations were compared to rainfall data derived from a weather radar. In thunderstorm rainfall, radar calibration factors derived in real time may not be representative of rain falling over a river catchment some distance from the calibration raingages. Radar may also underestimate the rainfall resulting in an underestimation of the peak flow. The use of radar data, calibrated using the data from a number of telemetering raingages, as input to hydrological models, may lead on occasions to river hydrographs which are considerably in error. Likewise, the use of telemetery raingage data, particularly in localized rainfall, may also lead to incorrect flow forecasts. Only if ways can be found for dealing with errors in radar estimates of rainfall, will radar attain its potential in hydrological forecasting. (Peters-PTT)
W86-05111

OBSERVATIONAL RAINFALL-RUNOFF ANALYSIS FOR ESTIMATING EFFECTS OF CLOUD SEEDING ON WATER RESOURCES IN NORTHERN ISRAEL,
Tel-Aviv Univ. (Israel). Dept. of Statistics.
For primary bibliographic entry see Field 3B.
W86-05115

TIME VARIATION OF RN 222 PROGENY CONCENTRATIONS IN RAINWATER,
Fukui Univ. (Japan). Faculty of Engineering.
T. Nishikawa, M. Aoki, and S. Okabe.
Health Physics, Vol. 49, No. 6, 1284-1289, December, 1985. 4 fig, 2 tab, 10 ref.

Descriptors: *Fate of pollutants, *Precipitation, *Rainfall, *Radon radioisotopes, *Temporal distribution, Seasonal variation, Rain, Chemistry of precipitation, Snow, Monitoring, Radioactive isotopes.

Radon-222 progeny that is brought to the ground surface by the scavenging effects of precipitation may cause a temporary increase in environmental gamma radiation and may upset monitoring efforts near nuclear facilities. Radon-222 progeny concentrations in precipitation were measured in Fukui Prefecture from 1982-1984 and examined in relation to such factors as atmospheric Rn-222 progeny, seasonal variation, and precipitation rate. Results showed that when the precipitation rate is low, the Rn-222 progeny concentration in rain is distributed over a wide range of values, and sometimes the concentration in a low-precipitation-rate rainfall is lower than the value of high-precipitation-rate rainfall. The statistics of deposited Rn-222 progeny showed an approximate linear relation to the precipitation rate. The Rn-222 progeny concentration in rain during the winter is about two times that which occurs during the other three seasons. Such seasonal variation is considered to be due to a high atmospheric Rn-222 progeny concentration in the air mass coming from Siberia or China during the winter. (Geiger-PTT)
W86-05142

RAINWATER FOR DRINKING IN SRI LANKA,
Loughborough Univ. of Technology (England). WEDC Group.
For primary bibliographic entry see Field 3B.
W86-05145

STATE ESTIMATION OF A SCALAR DYNAMIC PRECIPITATION MODEL FROM TIME-AGGREGATE OBSERVATIONS,
Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.
K. P. Georgakakos.
Water Resources Research WRERAO, Vol. 22, No. 5, p 744-748, May 1986. 1 tab, 9 ref.

Descriptors: *Estimating equations, *Precipitation, *Dynamic modeling, Data interpretation, Time-series analysis, Kalman filter, Model studies, Mathematical studies.

An exact, recursive, state estimator for linear, scalar systems was developed. Its observables are time integrals, over an interval delta-t, of linear functions of the state. In general, implementation of the estimator results in excessive computations. The computationally inexpensive, ordinary Kalman filter with inflated observation error variance is used to approximate the developed estimator in terms of prediction accuracy. Comparisons between the exact estimator and the Kalman filter, using precipitation data of various aggregation intervals delta-t, and a scaler dynamic precipitation model, shows that the Kalman filter develops a prediction bias as delta-t increases. (Lantz-PTT)
W86-05220

OVERLAND FLOW HYDROGRAPHS FOR SCS TYPE II RAINFALL,
Old Dominion Univ., Norfolk, VA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W86-05239

BINARY TIME SERIES OBTAINED FROM CONTINUOUS TIME POINT PROCESSES DESCRIBING RAINFALL,
Washington Univ., Seattle. Dept. of Statistics.
P. Guttorp.
Water Resources Research WRERAO, Vol. 22, No. 6, p 897-904, June 1986. 4 fig, 2 tab, 26 ref, append. NSF Grant MCS-8302573.

Descriptors: *Time series analysis, *Rainfall, Model studies, Data interpretation, Statistical analysis, Mathematical analysis, Poisson ratio, Mathematical studies, Washington.

Continuous time point process models have been used in recent work on modeling rainfall occurrence. In many cases the available data is not sufficiently precise to properly fit such a model. For example, if only occurrence or nonoccurrence of precipitation is given daily, a more appropriate model would be a binary time series. In this work, some parameters of the time series obtained, are related to parameters of the underlying (but not observed) continuous time process. The details for several models proposed in the literature, such as the Neyman-Scott Poisson cluster process and the Smith-Karr renewal Cox process are carried out. An application of the theory is illustrated on some Washington State rainfall data. (Lantz-PTT)
W86-05249

PREDICTING PH, ALKALINITY, AND TOTAL ACIDITY IN STREAM WATER DURING EPISODIC EVENTS,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 5B.
W86-05250

SEASONAL AND REGIONAL VARIABILITY OF PARAMETERS FOR STOCHASTIC DAILY PRECIPITATION MODELS: SOUTH DAKOTA, U.S.A.,
Agricultural Research Service, Tucson, AZ.
D. A. Woolhiser, and J. Roldan.
Water Resources Research WRERAO, Vol. 22, No. 6, p 965-978, June 1986. 9 fig, 9 tab, 27 ref.

Descriptors: *Seasonal variation, *Regional variation, *Precipitation, *Model studies, *South Dakota, Mathematical models, Markov process, Fourier analysis.

Fourier series are used to describe the seasonal variation of the five parameters for a stochastic model of daily precipitation, utilizing a first-order Markov chain for the occurrence process and a mixed exponential distribution for the daily precipitation amounts (MCME model). Spatial variability of the means of each parameter for 16 stations in South Dakota has been illustrated by mapping isopleths. MCME parameters for 4 stations not included in the analysis are more closely described by the arithmetic mean of parameters for the 6 nearest stations, than by using parameters for the nearest neighboring station or parameters estimated by spline fitting or linear interpolation. MCME parameters estimated by all interpolation methods were significantly different from parameters identified for each of the four stations by maximum likelihood techniques. The principal source of this spatial variability, at distances on the order of 100 km, is data inconsistency due to methodological differences affecting small precipitation amounts related to observation time. Sampling error, possible parameter identifiability problems, and real differences in the precipitation regime on a scale smaller than the station spacing also contribute to the observed variability. (Lantz-PTT)
W86-05257

UPDATED CLIMATE FEEDBACK DIAGRAM,
Maryland Univ., College Park. Dept. of Meteorology.
A. Robock.
Bulletin of the American Meteorological Society, Vol. 66, No. 7, p 786-787, July 1985. 1 fig, 10 ref.
NSF Grant No. ATM-8213184.

Descriptors: *Climate, *Feedback, Vegetation, Thermal inertia, Meltwater, Air temperature, Albedo.

Three new climate elements have been added to the Kellogg and Schneider climate feedback diagram: vegetation, thermal inertia, and meltwater. These more clearly distinguish external forcing and heat fluxes. This diagram will be of use in understanding the complex interactions in the climate system that can feed back on surface air temperature. (Author's abstract)
W86-05314

DISTRIBUTION OF ACID DEPOSITION IN GERMANY,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
For primary bibliographic entry see Field 5B.
W86-05413

ATMOSPHERIC AMMONIUM SULPHATE DEPOSITION AND ITS ROLE IN THE ACIDIFICATION AND NITROGEN ENRICHMENT OF POORLY BUFFERED AQUATIC SYSTEMS,
Katholieke Univ. Nijmegen (Netherlands). Lab. of Aquatic Ecology.
For primary bibliographic entry see Field 5B.
W86-05414

EFFECTS OF ACID DEPOSITION ON CROPS AND FORESTS,
Imperial Coll. of Science and Technology, London (England). Dept. of Pure and Applied Biology.
For primary bibliographic entry see Field 5B.
W86-05415

2C. Snow, Ice, and Frost

EXPERIMENTS ON AEROSOL SCAVENGING BY NATURAL SNOW CRYSTALS PART III. THE EFFECT OF SNOW CRYSTAL CHARGE ON COLLECTION EFFICIENCY,
Hokkaido Univ., Sapporo (Japan). Graduate School of Environmental Science.
M. Murakami, C. Magono, and K. Kikuchi.

Journal of the Meteorological Society of Japan, Vol. 63, No. 6, p 1127-1137, December 1985. 2 tab, 9 fig, 25 ref.

Descriptors: *Snow, *Aerosols, Crystals, Electrostatic charge, Precipitation.

The collection efficiency of charged snow crystals for micron and submicron aerosol particles was studied in an aerosol chamber, and compared with that of uncharged snow crystals to investigate the effect of electrostatic forces on collection efficiency. The collection efficiency of charged natural snow crystals for aerosol particles of 0.1 micrometers to 6 micrometers in diameter was experimentally examined under conditions where phoretic forces and external electric fields were negligible. The enhancement of collection efficiency due to electrostatic charges on snow crystals increased with the decreasing aerosol size, and became maximum around 0.2 milimeters in diameter. Coulombic force was the dominant electrostatic force under these experimental conditions. (Peters-PTT)
W86-05093

CATASTROPHIC LAKE DRAINAGE WITHIN THE HOMATHKO RIVER BASIN, BRITISH COLUMBIA,
British Columbia Hydro and Power Authority, Vancouver. Geotechnical Dept.
For primary bibliographic entry see Field 2H.
W86-05104

PHOTOSYNTHETIC PRODUCTION OF A BRACKISH WATER COMMUNITY OF CHARA TOMENTOSA L. AND ITS DEPENDENCE ON ENVIRONMENTAL CONDITIONS,
Rostock Univ. (German, D.R.). Dept. of Biology.
E. Libbert, and T. Walter.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 3, p 359-368, 1985. 3 tab, 5 fig, 11 ref.

Descriptors: *Photosynthesis, *Respiration, *Algal growth, *Primary productivity, *Brackish water, Kerr Bight, Salinity, Hydrogen ion concentration, Temperature effects, Chlorophyll, Seasonal variation.

Continuously recording devices were used to measure diurnal and seasonal variations in net photosynthesis, dark respiration and net primary production of the alga Chara tomentosa in a brackish water bight, Kerr Bight, beside the Zingster Strom. The diurnal variations in the net photosynthesis rate closely followed the variations in the photosynthetically active radiation (PhAR) flux under water. The dependence of the net photosynthesis rate on the PhAR flux is represented by a saturation curve with the light compensation point at 1.9 J/sq cm/hr and light saturation >25 J/cu cm/hr. The net photosynthesis fluence correlated with the PhAR fluence. The dependence of net photosynthesis fluence on the PhaR fluence was linear and showed no tendency towards light saturation under the natural light regime. Photosynthesis correlated better with the PhAR under water than with global radiation. Net photosynthesis did not correlate with the temperature, salinity or hydrogen ion concentration of the water or with the chlorophyll content of the plants, but only with radiation. Dark respiration correlated positively with the water temperature and, possibly, negatively with the salinity. There was a negative correlation between net primary production and water temperature. The chlorophyll content of Chara tomentosa was subject to seasonal variations which exhibited a delayed inverse relationship to similar variations in the radiation fluence. (Peters-PTT)
W86-05151

MONTE CARLO SIMULATION OF SNOW DEPTH IN A FOREST,
McMaster Univ., Hamilton (Ontario). Dept. of Geography.
M. -K. Woo, and P. Steer.
Water Resources Research WRERAO, Vol. 22, No. 6, p 864-868, June 1986. 5 fig, 1 tab, 7 ref.

Descriptors: *Snow surveys, *Runoff forecasting, *Monte Carlo method, *Simulation analysis, *Snow depth, *Forests, Cost analysis, Field tests, Mathematical analysis, Model studies, Mathematical studies, Ontario, Spruce trees.

To reduce the cost of extensive field sampling for obtaining mean depths of snow in forests, a simulation model was developed. First the location of individual trees in a representative portion of the forest is either surveyed in the field, or simulated based on the statistical characteristics pertaining to the distribution of trees. In this forest, a large number of randomly located sample points is generated by Monte Carlo technique. The azimuth and distance from each point to the nearest tree is determined, and a snow depth simulated based on the observed snow depth distribution around individual trees. The model was applied successfully to a northern spruce forest in subarctic Ontario, showing that this simulation provides a useful approach to determine mean snow depth. (Lantz-PTT)
W86-05244

2D. Evaporation and Transpiration

PREDICTIONS OF SOIL-WATER POTENTIALS IN THE NORTH-WESTERN SONORAN DESERT,
California Univ., Los Angeles. Dept. of Biology.
For primary bibliographic entry see Field 2G.
W86-04695

SEASONAL AND DIURNAL VARIATION OF ENERGY BUDGET COMPONENTS IN CONIFEROUS FORESTS,
Sveriges Lantbruksuniversitet, Uppsala. Inst. foer Ekologi och Miljoevaard.
A. Lindroth.
Journal of Hydrology, Vol. 82, No. 1/2, p 1-15, November 1985. 6 fig, 1 tab, 29 ref.

Descriptors: *Seasonal variation, *Diurnal variation, *Energy budget, *Coniferous forests, *Evapotranspiration, Net radiation, Heat flux, Energy storage, Sweden, Air temperature, Soil water, Precipitation.

Simultaneous measurements of evapotranspiration from the ground vegetation and the whole forest were made in a coniferous forest in Sweden. About 59% of the net radiation was used for latent heat flux, 32% for sensible heat flux, and 9% for storage. Only 13% of the latent heat flux came from the ground vegetation while more than 50% of the sensible heat flux originated from the ground. The rate of latent heat flux from forests does not constitute a constant fraction of the net radiation. Monthly mean daytime latent heat flux varies relatively little during the season for a specific forest. Soil water availability, averaged over a longer period, might be a better scaler for mean rate of latent heat flux than the density of the forest. (McFarlane-PTT)
W86-05296

2E. Streamflow and Runoff

HYDRAULICS OF TWO FLOWING LAYERS WITH DIFFERENT DENSITIES,
Scripps Institution of Oceanography, La Jolla, CA.
L. Armi.
Journal of Fluid Mechanics, Vol. 163, p 27-58, 1986. 6 fig, 28 ref, 2 append.

Descriptors: *Two-layer flow, *Froude number, *Density currents, *Sill, *Contraction, *Mathematical analysis, *Critical flow, Subcritical flow, Supercritical flow, Fluid mechanics, Internal hydraulics, Channel width, Flow contraction.

A theoretical and experimental study describes the basic hydraulics of two flowing layers. A new treatment of their internal hydraulics of two-layer flows parametrized the flows in terms of the internal Froude numbers for each layer. This permitted presentation of all possible flows for two layers through contractions and over sill for selected values of the flow ratio, q sub r. The effects of a sill on a two-layer flow differ from those of a contraction, because the sill only directly contacts the bottom layer and the upper layer's response is indirect. With parametrization in terms of the internal Froude numbers and presentation of flow solutions as curves of the Froude-number plane, the conditions for critical flow, which define all of the essential characteristics of the internal hydraulics, become a straight line separating the plane into subcritical and supercritical regions. This has allowed the solutions to be easily interpreted and shows clearly the location of controls, including virtual controls, multiple solutions, matching conditions, and hydraulic jumps. For a contraction, specification of the flow rate alone does not lead to a unique solution. In the general case, with control at the narrowest section of a contraction, there are two distinct solutions. Laboratory experiments confirm their existence. In contrast to free-surface flows, two-layer flows can be internally critical at other than the narrowest section of the channel. (Rochester-PTT)
W86-04714

RIVER MECHANICS,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 2J.
W86-04750

DAILY FLOW STATISTICS OF ALASKAN STREAMS,
National Weather Service, Anachorage, AK. Alaskan River Forecast Center.
For primary bibliographic entry see Field 4A.
W86-04784

ADVANCES IN HYDROMETRY.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 7B.
W86-04785

UP-DATING OF DISCHARGE RATING CURVES BY MEANS OF MATHEMATICAL MODELS,
Institut fuer Wasserwirtschaft, Berlin (German D.R.).
For primary bibliographic entry see Field 7B.
W86-04789

METHOD FOR UNIFORMIZING THE STAGE-DISCHARGE RELATIONS OF STABLE RIVER BEDS AND ITS APPLICATION,
Yangtze Valley Planning Office, Wuhan (China).
For primary bibliographic entry see Field 7B.
W86-04790

EQUATIONS FOR ESTIMATING DISCHARGE IN STEEP CHANNELS WITH COARSE BED MATERIAL,
Institute of Hydrology, Wallingford (England).
J. C. Bathurst.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 63-71, 5 tab, 10 ref.

Descriptors: *Channels, *Mathematical equations, *Discharge measurement, *River beds, *Stage-discharge relations, Flow discharge, Mathematical models, Sediment transport, Model studies, Hydrometry, Flow characteristics.

The use of process-based conveyance equations for estimating discharge in steep channels with coarse bed material is discussed. As the hydraulic characteristics of such channels often preclude direct gagin techniques, it is necessary to use the indirect slope-area method in which peak discharges are calculated as functions of channel slope and conveyance, the latter itself being a function of channel cross-sectional shape and bed material size. Previous application has been hampered by a lack of knowledge concerning flow processes in steep channels but, with the equations now available, variations of conveyance with depth, bed material size and sediment movement can be estimated.

Using data from the Yemen Arab Republic, it is shown that discharge predictions by these equations have an accuracy of about 10% for low flows and are of the correct order of magnitude at a flood flow. The construction of a stage/discharge relationship is demonstrated and assumptions behind the method are discussed. (See also W86-04785) (Author's abstract)
W86-04791

MULTILAYER WIDTH-INTEGRATED VELOCITY MEASUREMENT METHOD,
Fujian Provinicial Hydrometric Station, Fuzhou (China).
For primary bibliographic entry see Field 7B.
W86-04792

SATELLITE DATA AS BASIS FOR THE ESTIMATION OF RAINFALL AND RUNOFF,
Bochum Univ. (Germany, F.R.).
For primary bibliographic entry see Field 7B.
W86-04809

DETERMINATION OF A MEASURING NETWORK ALONG RIVERS,
Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering.
For primary bibliographic entry see Field 7A.
W86-04811

RIVER BASINS,
Food and Agriculture Organization of the United Nations, Rome (Italy).
For primary bibliographic entry see Field 8I.
W86-04816

RECENT DEVELOPMENTS IN THE EXPLANATION AND PREDICTION OF EROSION AND SEDIMENT YIELD.
International Association of Hydrological Sciences.
For primary bibliographic entry see Field 2J.
W86-04896

EFFECTS OF WATER DEVELOPMENT ON THE HYDROLOGY AND MORPHOLOGY OF PLATTE RIVER CHANNELS, SOUTH-CENTRAL NEBRASKA,
Geological Survey, Denver, CO.
R. F. Hadley, and T. R. Eschner.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 3-10, 4 fig, 1 tab, 10 ref.

Descriptors: *Industrial development, *Agricultural hydrology, *Water resources development, *Hydrological aspects, Water level, Water management, Streamflow, Water supply development, Dams, Platte River, Colorado, Wyoming, Nebraska.

The channels of the Platte River and its major tributaries, the North Platte and South Platte Rivers in Colorado, Wyoming and Nebraska have undergone major changes in hydrologic regime and morphology since about 1860. These changes are attributed here to water development for agricultural, municipal, and industrial uses. Prior to water development in the nineteenth century, the Platte River was a wide (approximately 2 km), shallow (1.8 - 2.4 m) river characterized by bankfull spring floods and low summer flows. Since development, the channels have changed significantly. Channel widths in the 1970's at six locations between Cozad and Ashland, Nebraska, ranged from 9 to 92% of the 1860 widths. Flow regulation by onstream dams and reservoirs, diversions of surface water, power generation, and other uses have also had significant effect on the hydrology of the basin. (See also W86-04896) (Author's abstract)
W86-04897

EFFECTS OF SLOPE LENGTH AND TERRACING ON RUNOFF AND EROSION ON A TROPICAL SOIL,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
R. Lal.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 23-31, 5 fig, 5 tab, 11 ref.

Descriptors: *Runoff, *Soil erosion, *Erosion control, Soil stability, Erosion rates, Sediments, Sediment control, Sediment erosion, Agricultural engineering, Nigeria, Slopes.

Runoff and soil erosion measurements were made for 5, 10, 12.5, 15, 20, and 37.5 m slope lengths on tropical soils of 10 and 15% slopes in western Nigeria. Comparisons were also made for runoff and erosion from terraced and unterraced basins of 3-4 ha in size and managed with the conventional and no-tillage systems. Runoff per unit area was more from short than long slopes and decreased at the rate of 6 mm/m/yr. On the contrary, the soil erosion increased linearly with the increase in slope length at the rate of 2.4 t/ha/m for slope lengths between 5 and 20 m. The sediment load per unit runoff also increased with the increase in slope length at the rate of 25 kg/mm/m. Terracing decreased erosion and water runoff on ploughed basins, and was not necessary on untilled basins. The no-till system with crop residue mulch is an effective erosion preventive measure. (See also W86-04896) (Author's abstract)
W86-04899

LONG TERM PREDICTION OF THE EXTREMES OF RIVER BED LEVEL FLUCTUATIONS,
Institute of Meteorology and Water Management, Warsaw (Poland).
J. Branski, and J. Zelanzinski.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 117-122, 1 fig, 1 tab, 3 ref.

Descriptors: *Stream flow, *Erosion, *Sediments, *River beds, transport, Sediment erosion, Flow, Sediment load, Sediment carrying capacity, Flow measurement, Vistula River, River mechanics.

The extremes of river bed fluctuations are controlled by accumulation processes which are closely related to flow variations. Because of problems in developing a physically-based model of such fluctuations it is useful to consider them as a random process and to develop probabilistic models for prediction. Data obtained for a number of flow gaging stations on the River Vistula have been used to develop long term records of bed level fluctuations. These fluctuations have been described using a simple probabilistic model with a linear trend component and a normal random deviation component. This model has been fitted successfully to records from five gaging stations on the Vistula and permits prediction of bed level variations up to the year 2020. (See also W86-04986) (Author's abstract)
W86-04909

SURFACE FLOW AND EROSIONAL PROCESSES IN SEMIARID MESCOSCALE CHANNELS AND DRAINAGE BASINS,
Scarborough Coll., Westhill (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W86-04910

GULLY HYDROLOGY AND RELATED SOIL PROPERTIES IN LESOTHO,
National Univ. of Lesotho, Roma.
Th. Faber, and A. C. Imeson.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 135-144, 3 fig, 7 tab, 16 ref.

Descriptors: *Gullies, *Hydrology, *Runoff, *Rainfall-runoff relationships, Erosion, Africa, Soil properties, Sedimentation, Hydrographs, Lesotho, Roma, Maama Gully.

The lowland soils and recent sediments of western Lesotho in southern Africa have been and are being seriously damaged by gully erosion. The runoff events recorded during the wet season of 1979/1980 in the Maama Gully near Roma, Lesotho, are described together with a number of soil properties which are thought to influence gully runoff and erosion. Runoff events are of very short duration and constitute only a small percentage of the total basin precipitation. Most rainfall was easily retained by the catchment soils. Relationships between rainfall and runoff events are described and discussed. It is concluded that most runoff is generated close to the gully on the motorable trackways and that during the period of study more material was eroded from the gully headcuts than left the gully at the gauging station. The evacuation of sediment must be the result of runoff events more extreme than those observed. Attention is drawn to differences between the Maama gully and many of the other gullies in Lesotho where piping is important. (See also W86-04896) (Author's abstract)
W86-04911

DEVELOPMENT OF A PROCEDURE TO ESTIMATE RUNOFF AND SEDIMENT TRANSPORT IN EPHEMERAL STREAMS,
Agricultural Research Service, Tucson, AZ. Southwest Watershed Research Center.
For primary bibliographic entry see Field 2J.
W86-04925

REAERATION RATE ESTIMATION USING THE LAG IN DISSOLVED OXYGEN CONCENTRATION,
Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
M. G. Waldon.
Journal of Environmental Science and Health JESEDU, Vol A20, No. 6, p 661-679, August 1985. 3 fig, 1 tab, 6 ref. Dept of Interior cooperative agreement 14-34-0001-1120, OWRT project no. A-054-LA.

Descriptors: *Reaeration coefficient, *Dissolved oxygen concentration *Peak lag method, Hydrology, Streams.

Two new methods are derived for the estimation of the reaeration coefficient in a stream. The first method, termed the 'peak lag method' (PLM), calculates the reaeration coefficient, K, using the observed time lag between solar noon and the maximum afternoon dissolved oxygen concentration. Computer simulation demonstrates that this technique is less accurate for small values of K or short day length. By using a correction term calculated from the observed time lag and the day length, a second technique, termed the 'modified PLM,' is developed which has improved accuracy in these situations. These methods require only 3 to 5 hours of monitoring to determine the time of the peak, avoiding the logistical problems associated with monitoring throughout the night. Moreover, the PLM does not require data on stream temperature or light intensity, and requires dissolved oxygen data only during the afternoon around the time of its peak value. The PLM also may provide secondary estimates of the reaeration coefficient to corroborate the estimates of older and more widely accepted techniques. (Doria-PTT)
W86-05060

HYDROLOGIC CHARACTERISTICS AND MODELLING OF A SMALL FORESTED CATCHMENT IN SOUTHEASTERN NEW SOUTH WALES. PRE-LOGGING CONDITION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water

and Land Resources.
I. D. Moore, S. M. Mackay, P. J. Wallbrink, G. J. Burch, and E. M. O'Loughlin.
Journal of Hydrology, Vol. 83, No. 3/4, p 307-335, March 1986. 3 tab, 11 fig, 33 ref.

Descriptors: *Australia, *Catchment basins, *Rainfall-runoff relationships, New South Wales, Geebung Creek, Hydraulic conductivities, Model studies, Forests, Storm runoff, Vegetation effects, Hydrologic models, Storm seepage, Saturation zone, Land use, Hydrologic properties.

Analysis of the storm event rainfall and runoff data and other physical data from the undisturbed Geebung Creek catchment (about 30 km inland from the southeast coast of New South wales in the 51,300 ha Yambulla State Forest, Australia) shows that its hydrologic behavior is well described by the variable source area concept. Runoff is believed to occur mainly from saturated source areas that are fed by rapid subsurface flow from upslope. A theoretical steady-state saturation zone model has been applied to identify the size and location of zones of saturation in the landscape under a range of wetness conditions. Field observations confirm the general predictions made by the model. Linkage of the results from this model with a simple rainfall-runoff model provides a means of modelling the hydrologic response of the catchment to precipitation in terms of the dynamic expansion and contraction of the saturated source areas. The results of the rainfall-runoff simulation on the Geeburg Creek catchment are very good, indicating that this methodology may have considerable potential for evaluating impacts of land use change on the hydrology of certain types of catchments, at the process level. The modelling techniques adopted have the potential to greatly increase the predictive power of such process models. It may thus provide a rational and quantitative basis for the extrapolation of results obtained from limited observations on experimental treatment effects imposed on the vegetation and soils of specific catchments. (Peters-PTT)
W86-05116

OBJECTIVE IDENTIFICATION OF MEANDERS AND BENDS,
State Univ. of New York at Buffalo. Dept. of Geography.
M. P. O'Neill, and A. D. Abrahams.
Journal of Hydrology, Vol 83, No. 3/4, p 337-353, March 1986. 2 tab, 9 fig, 34 ref.

Descriptors: *Meanders, *Bends, Mansfield Creek, Channel morphology, New York, Mathematical studies, Stream banks, Streams.

A distinction is made between simple half-meanders, which contain a single bend, and complex half-meanders, which contain multiple bends. A method of objectively identifying such half-meanders and bends along a channel reach is developed. Traditional methods of studying meander planform geometry have assumed that meanders contain a single bend or apex and that the inflection points or half-meander endpoints can be identified unambiguously. Along many meandering channel reaches both assumptions are often violated. The planform differencing technique is based on direction-change measurements made at a fixed-point interval along the channel and uses a single criterion variable, the half-meander tolerance, to identify half-meanders and bends alike. A second criterion variable, the bend tolerance, is employed to determine the lengths of bends. The planform differencing technique permits meanders and bends to be identified on the basis of explicitly stated quantitative criteria and yields reproducible and spatially consistent results. When the technique was applied to a small meandering stream in Western New York (Mansfield Creek, approximately 65 km south of Buffalo, NY), it revealed that almost half the bends do not contain pools. The dearth of pools in relatively open bends is at odds with the idea that bends form at pools by the lateral migration of the outswinging channel thalweg. The development of bends at locations other than pools appears to be caused mainly by inhomogeneities in the bank material. (Peters-PTT)
W86-05117

EPIPELIC ALGAL FLORA OF THE RIVER WYE SYSTEM, WALES, UK. 1. PRODUCTIVITY AND TOTAL BIOMASS DYNAMICS,
University Coll., Cardiff (Wales). Dept. of Plant Science.
For primary bibliographic entry see Field 2H.
W86-05158

SOME OBSERVATIONS ON HOCHSTETTER'S FROG IN THE CATCHMENT OF THE MOTU RIVER, EAST CAPE,
Department of Scientific and Industrial Research, Havelock North (New Zealand). Ecology Div.
For primary bibliographic entry see Field 2H.
W86-05197

DRAINAGE FROM A UNIFORM SOIL LAYER ON A HILLSLOPE,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
F. Stagnitti, M. B. Parlange, T. S. Steenhuis, and J. -Y. Parlange.
Water Resources Research WRERAO, Vol. 22, No. 5, p 631-634, May 1986. 1 fig, 17 ref. University Research Grant and Australian Research Grant Scheme F 84161771.

Descriptors: *Drainage, *Rainfall-runoff relationships, *Uniform soil layer, *Slopes, *Runoff, Streamflow, Model studies, Mathematical studies, Appalachian Mountains, Richards equation, Mathematical models, Soil water, Hydrologic models.

A simplified drainage model adapted from previous research, has been demonstrated to provide a good approximation of Richard's equation when applied to the this data was obtained through observations collected from a small and well-defined hillslope segment at the Coweeta Hydrological Laboratory, in the southern Appalachian mountains. The model gives reliable prediction of both short- and long-term drainage. The one distinct advantage that the simplified drainage model exhibits over other models, is that it is fully analytic and can be used to predict drainage and cumulative drainage profiles instantly and without recourse to computer algorithms. Such simplicity suggests possible future integration into existing models used for predicting watershed discharge. (Lantz-PTT)
W86-05209

MIGRATION PATTERNS OF AN ASYMMETRIC MEANDERING RIVER: THE ROUGE RIVER, QUEBEC,
National Hydrology Research Inst., Hull (Quebec).
M. F. LaPointe, and M. A. Carson.
Water Resources Research WRERAO, Vol. 22, No. 5, p 731-743, May 1986. 13 fig, 40 ref.

Descriptors: *River flow, *Meanders, *Rouge River, *Quebec, *Bank erosion, Sediment transport, Flow pattern, Flow velocity, Channel flow, Erosion, Suspended sediments.

The migration patterns responsible for the asymmetry of the highly sinuous Rouge River meanders, are described and related to the hydraulic and sediment transport patterns controlling bank erosion in these bends. Two elements of the overall migration patterns play important roles in maintaining asymmetry, and raise fresh questions concerning the understanding of erosion processes. The first is that significant outer bank erosion starts remarkably early at bend entrances, well before crossover of the high velocity filament. Second, such erosion extends far along the cross-valley reaches, despite the very gentle channel curvatures between meander apices. Data on high-flow suspended sediment transport and helix structure suggest how, beyond the control exerted near-bank shear stresses, the spatial patterns of near-bed primary and secondary flows can also exert an influence on the distribution of bank erosion, by controlling the evacuation of the influxes of eroded bank materials. (Lantz-PTT)
W86-05219

WATER DISCHARGE AND SUSPENDED SEDIMENT CONCENTRATIONS IN THE AMAZON RIVER: 1982-1984,
Washington Univ., Seattle. School of Oceanography.
J. E. Richey, R. H. Meade, E. Salati, A. H. Devol, and C. F. Nordin.
Water Resources Research WRERAO, Vol. 22, No. 5, p 756-764, May 1986. 6 fig, 3 tab, 18 ref. NSF Grant No. BSR-8107522.

Descriptors: *Water discharge, *Suspended sediments, *Amazon River, Water measurement, Sediment transport, Sediment load, Data acquisition, Data interpretation, Vargen Grande, Rio Madeira, San Jose du Amatari, Brazil, Current meters, Sampling, Velocity.

An equal-width-increment procedure was developed to measure water discharge and the suspended sediment load of the Amazon River and its principal tributaries. A variable speed hydraulic winch deploys an instrument array of a sounding weight, Price current meter, and collapsible bag sampler by lowering it from the surface to the bottom and back at a constant velocity. Eighteen verticals are taken at main stem stations (fewer on tributaries), with positioning determined by shipboard observation with a sextant monitoring angles from a three-marker baseline on the shore. Confidence intervals (95%) for discharge and the fluxes of fine (<0.063 mm) and coarse (>0.063 mm) suspended sediments (CSS) were 5%, 10% and 20% respectively. Water discharge varied from 31,700 cu m/s to 203,000 cu m/s downriver at Obidos. Concentrations of fine suspended sediments (FSS) generally decreased downstream from 220-490 mg/L at Vargem Grande to 110-250 mg/L at Sao Jose do Amatari. Large concentrations fo FSS at high water in the Rio Maderia of 590-770 mg/L increased downstream concentrations of FSS in the Amazon. CSS had some of the same distribution and transport patterns as the FSS, but with only 20-30% of the concentration. (Lantz-PTT)
W86-05222

FLOOD FREQUENCY ANALYSIS WITH HISTORICAL AND PALEOFLOOD INFORMATION,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
J. R. Stedinger, and T. A. Cohn.
Water Resources Research WRERAO, Vol. 22, No. 5, p 785-793, May 1986. 6 fig, 5 tab, 43 ref, append. NSF Award CEE-8351819.

Descriptors: *Floods, *Frequency analysis, *Historic floods, Literature reviews, Monte Carlo method, Flood recurrence interval, Flood forecasting, Statistical analysis.

An investigation was made of flood quantile estimators which can employ 'historical' and paleoflood information in flood frequency analyses. Through an extensive literature review, two categories of historical information were obtained: 'censored' data, where the magnitudes of historical flood peaks are known; and 'binomial' data, where only threshold exceedance information is available. A Monte Carlo study employing the two-parameter lognormal distribution shows that maximum likelihood estimators (MLEs) can extract the equivalent of an additional 10-30 years of gage record from a 50-year period of historical observation. The MLE methods performed well even when floods were drawn from other than the assumed lognormal distribution. (Lantz-PTT)
W86-05225

PREDICTION OF SURFACE SATURATION ZONES IN NATURAL CATCHMENTS BY TOPOGRAPHIC ANALYSIS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
E. M. O'Loughlin.
Water Resources Research WRERAO, Vol. 22, No. 5, p 794-804, May 1986. 8 fig, 17 ref.

Descriptors: *Surface water, *Saturation zone, *Topography, *Storm runoff, *Soil saturation,

Catchment basins, Drainage patterns, Geohydrology, Soil properties, Transmissivity, Slopes, Prediction, Surface runoff, Transpiration.

The topography of hillslopes or whole catchments is analyzed numerically to calculate local geometric and drainage attributes that can be combined to test for the expectation of soil waterlogging. At locations where the accumulated drainage flux from upslope exceeds the product of soil transmissivity and the local slope, saturation to the soil surface occurs. Results of an analysis of specific landscapes are presented as a location dependent function. The function may be mapped as isolines to define successive boundaries of zones of soil saturation, depending on the wetness state of the landscape as a whole. The analysis is applied to two catchments, to predict the growth or contraction of zones of waterlogging for a range of drainage fluxes, and to simulate the effects of transpiration changes in part or all of the catchment. In the second application, the predicted boundaries of saturated zones are used to calculate the minimum proportion of a catchment's area that produces rapid surface runoff. This proportion is shown to depend on the value of a normalized wetness parameter. Storm runoff data has been shown to support the predicted form of the relationship. (Lantz-PTT)
W86-05226

OVERLAND FLOW HYDROGRAPHS FOR SCS TYPE II RAINFALL,
Old Dominion Univ., Norfolk, VA. Dept. of Civil Engineering.
A. O. Akan.
Journal of Irrigation and Drainage Engineering JIDEDH, Vol. 111, No. 3, p 276-286, September 1985. 10 fig, 11 ref.

Descriptors: *Overland flow, *Rainfall-runoff relationships, *Hydrographs, *Rainfall, *Infiltration, Mathematical analysis, Mathematical equations, Kinematic waves, Flow profiles, Runoff.

A mathematical model, founded on the kinematic-wave and Green-Ampt equations, is presented for the conjunctive overland flow-infiltration process. The following conclusions were drawn from this study: 1) Only three physically-based nondimensional parameters are sufficient to describe the conjunctive overland flow-infiltration process resulting from any rainfall of which the time distribution of intensity is specified; 2) Overland flow hydrographs for the 24-hr SCS-Type II rainfall can be approximated by triangular hydrographs; 3) It is possible to evaluate the triangular hydrographs in terms of three physically-based parameters, namely alpha*, K*, and P* representing the basin and rainfall characteristics; and, 4) The synthetic triangular hydrograph proposed in this paper predicts the peak discharge, the time of occurrence of the peak discharge and the volume of runoff before and after the hydrograph peak as accurately as a mathematical model founded on the kinematic overland and the Green-Ampt infiltration equations. (Lantz-PTT)
W86-05239

FLOOD FREQUENCY ANALYSIS USING THE COX REGRESSION MODEL,
Interstate Commission on the Potomac River Basin, Rockville, MD.
J. A. Smith, and A. F. Karr.
Water Resources Research WRERAO, Vol. 22, No. 6, p 890-896, June 1986. 2 fig, 3 tab, 22 ref, append.

Descriptors: *Flood frequency, *Frequency analysis, *Cox regression model, Flood forecasting, Water resources, Mathematical studies, Mathematical models, Appalachian Plateau, Snowpack, Flood control, Reservoirs, Soil moisture.

The Cox regression model provides a flexible tool for incorporating time-varying exogenous information pertaining to processes such as soil moisture storage, snow pack, and frozen ground into flood frequency analyses. The flood frequency model developed was based on the Cox regression model and simultaneously generalizes partial duration series models and mixture distribution models. Two applications of the model are illustrated. The model can be used in a hypothesis testing framework to assess the importance of specific processes on flood frequency at a site. Specifically, some estimation procedures are presented and a partial likelihood ratio test is developed for assessing the significance of 'covariates.' Inference procedures are applied to a 240 square mile catchment on the Appalachian Plateau. In this example, the covariate processes are snow pack and soil moisture storage. The Cox regression model can also be used to provide time-varying flood frequency estimates for water resource management problems. A formulation for a 'flood warning problem' is presented, based on the Cox regression model. In this example, operation of flood control storage of a reservoir is tied to time-varying estimates of flood risk. (Lantz-PTT)
W86-05248

EFFECT OF SERIAL CORRELATION ON RESERVOIR SIZE,
Monash Univ., Clayton (Australia).
For primary bibliographic entry see Field 2H.
W86-05253

RESISTANCE TO FLOW AND VELOCITY DISTRIBUTION IN RIGID BOUNDARY CHANNELS CARRYING SEDIMENT-LADEN FLOW,
M.B.M. Coll. of Engineering, Jodhpur (India).
A. K. Arora, K. G. R. Raju, and R. J. Garde.
Water Resources Research WRERAO, Vol. 22, No. 6, p 943-951, June 1986. 10 fig, 1 tab, 17 ref.

Descriptors: *Flow resistance, *Open channel flow, *Flow profiles, *Flow velocity, *Channel flow, *Sediment transport, Mathematical analysis, Boundary channels, Velocity distribution.

An experimental study on the characteristics of sediment-laden flow in rigid boundary open channels is reported. The data indicate that the friction factor for sediment-laden flows may be larger or smaller than that for clear water flow under the same conditions. The conditions leading to a decrease or increase in the friction factor have been identified, and a predictor was developed for the friction factor when it is greater than that for clear water flow. A velocity defect law has been obtained; the maximum velocity, in turn, is related to the average velocity in the cross section, the friction factor, and the aspect ratio. The results from the proposed law of velocity distribution are better than those from the existing laws for sediment-laden flow in rigid boundary channels. (Lantz-PTT)
W86-05255

2F. Groundwater

SPECIFIC HYDROMETRY OF KARST REGIONS,
Split Univ. (Yugoslavia). Faculty of Engineering.
O. Bonacci.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 321-333, 6 fig, 9 ref.

Descriptors: *Karst, *Hydrometry, *Ponors, *Poljes, *Hydrologic data collections, Piezometers, Water level, Boreholes, Borehole geophysics, Mathematicl studies, Rivers, Water loss, Sinks, Discharge measurements, Mathematicl models, Geohydrology, Groundwater, Remote sensing, Tracers, Springs.

Hydrologic data gathering methods in karst are presented. Measurement methods for water phenomena in karst can be classified as follows: piezometric boreholes in karst; tracers, speleological investigations; remote sensing; geophysical measurement methods; measurement of chemical composition of water and suspended and mineral substances in water; measurement of water temperature; and classical and specific hydrometric measurements in karst. Spring discharge curves can be obtained using water levels measured in piezometric boreholes in karst. Methods for organizing discharge measurements and establishing water losses along river channels in karst, whether in stationary and stagnant conditions or in non-steady flows are described. Some experiences with measuring and defining the ponor swallow capacity in the poljes subsystems of karst are examined. (See also W86-04785) (Geiger - PTT)
W86-04812

GROUNDWATER MOVEMENT STUDIED,
D. Senet, and B. Solomon.
Agricultural Research, Vol. 34, No. 1, p 12-13, January 1986. 2 fig.

Descriptors: *Irrigation, *Soil water movement, *Groundwater movement, *Groundwater pollution, *Soil water, Potassium bromide, Pasture, Agricultural Research Service.

Agricultural Research Service scientists have been studying preferential flow of irrigation water through the soil beneath fields. Previously, preferential flow of water through soil had been thought to be mainly associated with cracks, root holes, and worm holes. Such a flow can occur without large, obvious pores. Apparently added water was passing old water in the soil, and thus moving much faster than expected. In other studies, potassium bromide was applied to pastureland. The peak concentration was found 21 to 24 months later in water samples collected from springs supplied by the test watershed, and there was no significant decrease in concentration after 4 years. (Rochester-PTT)
W86-04983

MONITORING WELL SCREEN INFLUENCES ON DIRECT FLOWMETER MEASUREMENTS,
K-V Associates, Inc., Falmouth, MA.
For primary bibliographic entry see Field 7B.
W86-05026

VOLATILE ORGANIC CHEMICAL CONTAMINATION OF GROUNDWATER RESOURCES IN THE U.S.,
For primary bibliographic entry see Field 5B.
W86-05028

EVOLVING CONCEPTS OF SUBSURFACE CONTAMINANT TRANSPORT,
Robert S. Kerr Environmental Research Lab., Ada, OK.
For primary bibliographic entry see Field 5B.
W86-05029

BROMOFORM FORMATION IN OZONATED GROUNDWATER CONTAINING BROMIDE AND HUMIC SUBSTANCES,
Florida International Univ., Miami. Drinking Water Quality Research Center.
For primary bibliographic entry see Field 5F.
W86-05043

FIELD VALIDATION OF THE GEOHYDROLOGY SIMULATION MODEL, FEWA,
Miami Univ., Coral Gables, FL. Coll. of Engineering.
For primary bibliographic entry see Field 5B.
W86-05071

TWO-DIMENSIONAL POLLUTANT MIGRATION IN SOILS OF FINITE DEPTH,
University of Western Ontario, London. Geotechnical Research Centre.
For primary bibliographic entry see Field 5B.
W86-05102

ANALYTICAL SOLUTIONS FOR STRIP BASIN RECHARGE TO AQUIFERS WITH CAUCHY BOUNDARY CONDITIONS,
Thessaloniki Univ., Salonika (Greece). School of Technology.
P. Latinopoulos.

Journal of Hydrology, Vol. 83, No. 3/4, p 197-206, March 1986. 3 fig, 13 ref, append.

Descriptors: *Artificial recharge, *Aquifer characteristics, *Aquifers, *Recharge basins, *Groundwater recharge, Boundary conditions, Clogged stream bed, Basins, Mathematical models, Unconfined aquifers.

Analytical solutions for groundwater recharge from strip basins to finite aquifers are presented. The analysis comprises two cases of recharge regime: continuous (constant rate) and period recharge (seasonal variation). The solutions can be useful for assessing response as well as for calibrating numerical computer models. (Peters-PTT)
W86-05108

IN-SITU STUDY OF THE OCCURRENCE AND RATE OF DENITRIFICATION IN A SHALLOW UNCONFINED SAND AQUIFER,
Research Council of Alberta, Edmonton. Terrain Sciences Dept.
For primary bibliographic entry see Field 5B.
W86-05112

MODELLING OF RIVER WATER INFILTRATION USING OXYGEN-18 DATA,
Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg bei Munich (Germany, F.R.). Inst. fuer Radiohydrometrie.
W. Stichler, P. Maloszewski, and H. Moser.
Journal of Hydrology, Vol. 83, No. 3/4, p 355-365, March 1986. 3 tab, 8 fig, 3 ref.

Descriptors: *Mathematical models, *Infiltration, *Rivers, *Groundwater, Danube River, Passau, Environmental tracers, Observation wells, Model studies, Isotopic tracers, Flow, Stream banks.

Measurements of (18)O-content were used to determine the portion of bank infiltrated river water making up the groundwater of a 0.3 sq km island in the Danube River near Passau (F.R.G). Values of 77 and 96% were found for different measuring points. Applying mathematical flow models to the environmental tracer data, mean transit times of 48-120 days for the bank infiltrated water and a dispersion parameter of about 0.12 have been calculated. These estimates permitted prediction of the migration of possible pollution from the river to the observation and production wells. The successful use of this method for such bank filtration studies depends on a proper determination of input and output functions, and a significant isotopic difference between river water and groundwater. In this study the input function was measured directly in the river water. The sampling frequency of two samples per week of river water and of the water in the observation and production wells was high enough for calculating the mean monthly (18)O-content with sufficient accuracy. The (18)O-content of groundwater not influenced by bank filtrated river water was practically constant with time and clearly different from that of the river water. (Peters-PTT)
W86-05118

DECAY OF A DISTURBED FREE SURFACE IN AN ANISOTROPIC POROUS MEDIUM,
Norges Landbrukshoegskole, Aas. Dept. of Physics and Meteorology.
P. A. Tyvand.
Journal of Hydrology, Vol. 83, No. 3/4, p 367-371, March 1986. 4 ref.

Descriptors: *Anisotropy, *Groundwater movement, Porous media, Mathematical studies.

A two-dimensional linear theory of the decay of a disturbed free surface in an anisotropic porous layer is given. The porous medium is homogeneous and has an arbitrary two-dimensional anisotropy. The tilt of the streamlines is studied, and a formula for the decay rate is found. The decay of a disturbed free surface is an exceptionally simple mathematical problem: It allows an exact analytical solution also for the case where the principal axes are oblique to the coordinate axes. (Peters-PTT)
W86-05119

DETERMINATION OF SATURATED HYDRAULIC CONDUCTIVITY FROM SOIL PERCOLATION TEST RESULTS,
Oxford Univ. (England).
For primary bibliographic entry see Field 2G.
W86-05124

ANALYSIS OF GROUNDWATER QUALITY DATA OBTAINED FROM PRIVATE INDIVIDUAL WATER SYSTEMS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park. School of Forest Resources.
W. E. Sharp, D. W. Mooney, and R. S. Adams.
Northeastern Environmental Science, Vol. 4, No. 3-4, p 155-159, 1985. 3 tab, 5 ref.

Descriptors: *Groundwater pollution, *Water quality, *Monitoring, *Hydrologic data collections, *Coliforms, Wells, Nitrates, Sulfates, Drinking water, Groundwater, Geohydrology, Geology, Sodium, Acidity, Alkalinity, Turbidity.

Groundwater quality data were collected from all regions of Pennsylvania from 1874 to 1983 as a public service by the Soil and Forage Testing Laboratory, the Pennsylvania State University. The samples represented sources in which there was a perceived water quality problem. These data are summarized by origin or source water and region. Spring water supply sources were more frequently contaminated with bacteria than well water sources and 40% of all private individual water supplies sampled were contaminated by coliform bacteria. Computations of Ryznar Stability Index indicated that 59% of all individual water supplies had corrosive water. There were no statistically valid differences in the quality of water from wells under 80 ft deep as opposed to wells over 80 ft deep for any of the parameters measured except sodium which was greater in the deeper wells. Regional groundwater quality differences apparent in the data and seemed to be influenced by regional geology and groundwater pollution activities. The intensively farmed, carbonate areas of the Southeast and Southcentral regions had the highest median nitrate levels while the resistant rocks of the Northcentral region had the highest median Ryznar Stability Index value. Springs had significantly higher Ryznar Stability Index values than wells, indicating a possible atmospheric deposition influence for groundwaters with shorter residence times. Sulfates were highest in the Southwest where groundwater pollution from coal mining was prevalent. A substantial number of the private individual drinking water supplies did not meet drinking water standards. (Author's abstract-PTT)
W86-05140

GROUNDWATER RECHARGE ESTIMATE BY NUMERICAL MODELING: A CASE STUDY,
Port Harcourt Univ. (Nigeria). Dept. of Civil Engineering.
I. L. Nwaogazie.
Aqua AQUAAA, No. 2, p 77-80, 1986. 4 fig, 14 ref, 1 append.

Descriptors: *Groundwater recharge, *Mathematical modeling, *Case studies, Equilibrium, Irrigation water, Pumping, Water use, Model studies, Finite difference methods, Flow pattern, Groundwater movement, Groundwater availability.

The groundwater recharge parameter estimate of Pawnee Alluvial Valley, Kansas, prior to 1945, was performed under assumed conditions of steady state dynamic equilibrium. Pumpage for irrigation was very low, so the water table configuration was only minimally disturbed. A two-dimensional finite difference model was applied to a selected cross-section of the aquifer, generating head distribution for the development of equipotential lines and flow gradients. Simulation was geared toward the generation of a realistic flow pattern from a combination of anisotropic factors and layered cross-sections. An average recharge value of 1.30 in/yr was computed with corrections for both anisotropy and vertical exaggeration. (Lantz-PTT)
W86-05146

CURVILINEAR FINITE ELEMENT MODEL FOR SIMULATING TWO-WELL TRACER TESTS AND TRANSPORT IN STRATIFIED AQUIFERS,
GeoTrans, Inc., Reston, VA.
P. S. Huyakorn, P. F. Anderson, O. Guven, and F. J. Molz.
Water Resources Research WRERAO, Vol. 22, No. 5, p 663-678, May 1986. 13 fig, 1 tab, 27 ref. EPA Agreement CR 810704-01-0.

Descriptors: *Path of pollutants, *Injection wells, *Finite element method, *Model studies, *Simulation analysis, *Tracers, *Stratified flow, *Aquifers, *Groundwater movement, Solute transport, Mathematical models, Mathematical studies, Streamflow, Flow profile.

The problem of solute transport in steady nonuniform flow created by a recharging and discharging well pair was investigated. Numerical difficulties encountered with the standard Galerkin formulation in Cartesian coordinates are illustrated. An improved finite element solution strategy is presented to overcome the numerical problem, with the strategy based on a formulation performed in three-dimensional curvilinear coordinates. The formulation is developed especially for the simulation of two-well injection-withdrawal tracer tests conducted in homogeneous or stratified aquifers. The formulation can also be applied to other types of problems involving transport in homogeneous and stratified aquifers. A three-dimensional finite element approximation is derived by two successive applications of upstream weighted-residual and subdomain collocation procedures. First, the weighted residual procedure is formulated in the horizontal flow plane using curvilinear coordinates along normal streamlines. upstream weighting is included, but automatically controlled and limited to one dimension along the main flow direction. Second, the subdomain collocation procedure is formulated in the vertical dimension. Spatial discretization of the three-dimensional flow region is performed using a curvilinear finite element mesh that is point-centered in the horizontal plane and block-centered in the vertical direction. General algorithms are developed for mesh generation, time stepping and matrix reduction. The solution algorithm is designed to accomodate several thousand nodal unknowns with a minimal core storage and CPU time requirement. Two simulation examples are presented to verify and validate the numerical model in two dimensions using an analytical solution and experimental laboratory and field data. A comparative study shows that the proposed formulation is superior to the standard Galerkin formulation in Cartesian coordinates both in terms of accuracy and computational efficiency. The field simulation example indicates the need to conduct a more elaborate three-dimensional simulation study allowing for vertical variation in hydraulic conductivity. (Lantz-PTT)
W86-05213

GROUNDWATER FLOW AND SAND BODY INTERCONNECTEDNESS IN A THICK, MULTIPLE-AQUIFER SYSTEM,
Texas Univ. at Austin. Bureau of Economic Geology.
G. E. Fogg.
Water Resources Research WRERAO, Vol. 22, No. 5, p 679-694, May 1986. 15 fig, 1 tab, 38 ref. DOE Contract No. DE-AC97-80EV46617.

Descriptors: *Groundwater movement, *Aquifer systems, *Sand aquifers, Permeability, Conductivity, Geohydrology, Wilcox aquifer, Texas, Continuity, Mathematical studies, Model studies, Solute transport, Hydraulic head.

Many sandstone aquifers are actually multiple-aquifer systems, consisting of discontinuous sand bodies distributed complexly in a matrix of lower-permeability silts and clays. The arrangement and interconnectedness of these various lithofacies strongly influence spatial patterns of hydraulic conductivity (K) and, in turn, groundwater flow and mass transport. A promising technique for estimating such patterns of K involves careful analysis of both subsurface geologic and hydrologic data. In this study, the three-dimensional distribu-

tion of K was estimated for a numerical flow model of part of the Wilcox aquifer system in Texas, using K data from core samples and pumping tests, and more than 100 geophysical logs. The aquifer system, which is up to 320 m thick, consists of multiple, elongate sand bodies, and silts and clays deposited in a fluvial environment, and is similar to many other systems found in the Gulf Coast and other sedimentary basins. The resulting deterministic-conceptual flow model demonstrates the importance and methods of incorporating geologic information in groundwater models. Flow in the aquifer is shown to be controlled not so much by K of the sands as by their continuity and interconnectedness. Much of the aquifer system consists of large zones in which the fluvial channel-fill sands are sparse and apparently disconnected, resulting in groundwater flow rates lower by a factor of 100 to 10,000, than in adjacent, well-interconnected belts of fluvial channel-fill sand belts. Because the model is three-dimensional, sensitivity of hydraulic head to heterogeneity or interconnectedness is much less than normally observed in two-dimensional models, and therefore heads computed by the model give little to no indication of the location of well-interconnected zones. Thus such zones can easily go undetected, even in carefully calibrated models which yield reasonably accurate hydraulic heads. This is a significant point for the modeling of solute transport. (Lantz-PTT)
W86-05214

STOCHASTIC ANALYSIS OF THREE-DIMENSIONAL FLOW IN A BOUNDED DOMAIN,
Geological Survey, Denver, CO.
R. L. Naff, and A. V. Vecchia.
Water Resources Research WRERAO, Vol. 22, No. 5, p 695-704, May 1986. 7 fig, 13 ref.

Descriptors: *Stochastic processes, *Flow profiles, *Bound water, *Groundwater movement, Poisson ratio, Mathematical studies, Hydraulic head, Hydraulic conductivity, Aquifers, Model studies.

A commonly accepted first-order approximation of the equation for steady state flow in a fully saturated, spatially random medium has the form of Poisson's equation. This form allows for the advantageous use of Green's functions to solve for the random output (hydraulic heads) in terms of a convolution over the random input (the logarithm of hydraulic conductivity). A solution for steady state three-dimensional flow in an aquifer bounded above and below is presented; consideration of these boundaries is made possible by the use of Green's functions to solve Poisson's equation. Within the bounded domain, the medium hydraulic conductivity is assumed to be a second-order, stationary, random process as represented by a simple three-dimensional covariance function. Upper and lower boundaries are taken to be no-flow boundaries, with the mean flow vector lying entirely in the horizontal dimensions. This study indicates that as the flow path of a particle is restricted from three dimensions to two, the relative variance of the heads increases. If the flow path were further restricied so that one-dimensional flow perpendicular to layering occurred, then the head variance should increase yet more. However, if the restriction is such that flow is forced to parallel layering, then the head variances decrease. Head correlation increases with the transition from a three- to a two-dimensional flow system and then to one dimension with flow parallel to layering. The head correlation for one-dimensional flow perpendicular to layering, relative to two-dimensional flow, remains uninvestigated; intuitively, one would suppose that this one-dimensional flow case would have less head correlation than the two-dimensional case. (Lantz-PTT)
W86-05215

COMPARISON OF SEVERAL METHODS FOR THE SOLUTION OF THE INVERSE PROBLEM IN TWO-DIMENSIONAL STEADY STATE GROUNDWATER FLOW MODELING,
Geological Survey, Austin, TX. Water Resources Div.
L. K. Kuiper.
Water Resources Research WRERAO, Vol. 22, No. 5, p 705-714, May 1986. 1 tab, 8 ref.

Descriptors: *Groundwater movement, *Mathematical models, *Mathematical equations, *Statistical methods, Mathematical studies, Hydraulic conductivity, Hydraulic head, Kriging, Aquifers.

Two geostatistical approaches for the estimation of hydraulic conductivity and hydraulic head from hydraulic conductivity and hydraulic head measurements are developed for a two-dimensional steady flow with sinks. The first approach uses linearization of the discretized flow equations to allow the construction of a joint covariance matrix of the hydraulic head and log-conductivity measurements as functions of six possible parameters. It then uses maximum likelihood estimation to obtain these parameters and also a parameter associated with log-conductivity measurement error. Having found values for the parameters, it then uses kriging to form predictors for log-conductivity and hydraulic head from measured values of hydraulic conductivity and hydraulic head. The second approach uses kriging to form a parameter-dependent predictor for log-conductivity from measured hydraulic conductivity, and then uses this predicted log-conductivity placed into the discretized flow equations to compute hydraulic head. The parameters are determined by the minimization of the sum of the squares of the difference between the measured and computed hydraulic heads. A third approach simply allows the hydraulic conductivity field to be a step function with a different value for hydraulic conductivity assigned to each of several chosen regions in the two-dimensional aquifer. The assigned hydraulic conductivities are determined by the minimization of the sum of the squares of the difference between the measured and computer hydraulic heads. The three approaches are tested for hydraulic head prediction accuracy on two generated test problems, one of which is statistically generated, and also on a field problem. Results indicate that the third approach, despite its simplicity, performs as well or better than the other approaches. (Lantz-PTT)
W86-05216

COMPARATIVE STUDY OF THE GREEN AND AMPT ANALYSIS FOR A FALLING WATER TABLE IN A STRATIFIED PROFILE,
New South Wales Univ., Kensington (Australia). School of Civil Engineering.
K. K. Watson, and S. A. Awadalla.
Water Resources Research WRERAO, Vol. 22, No. 5, p 723-730, May 1986. 13 fig, 6 ref.

Descriptors: *Groundwater movement, *Mathematical analysis, *Water table decline, *Stratified flow, Water table profile, Mathematical studies, Gravity flow, Porous media, Mathematical equations, Sands, Soil porosity.

General equations are developed for a Green and Ampt type analysis of gravity drainage for falling water table conditions in an initially saturated stratified profile of porous material, both with and without the presence of an applied surface flux. The particular type of stratification system considered is one in which a coarse sequence of porous material overlies a fine sequence. Two profiles are used in the analysis: 1) a medium-textured sand overlying a slightly finer sand; and 2) the same medium-textured sand overlying a sandy loam. The results obtained by analyzing these cases using algebraic equations, are compared with results obtained from a computer-based numerical analysis of the differential equation describing water movement in unsaturated porous media. The results of the numerical simulations are given in terms of pressure head profiles and water content profiles. From these data, detailed comparisons are made with the Green and Ampt results in terms of the discharge-time relationship and the position of the draining from with time. For the systems considered, the simplified sharp-front analysis gives results of reasonable accuracy suggesting that the model would be satisfactory for certain types of field studies. (Lantz-PTT)
W86-05218

SOIL WATER MOVEMENT AND RECHARGE THROUGH SAND AT A SEMIARID SITE IN NEW MEXICO,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
For primary bibliographic entry see Field 2G.
W86-05247

VELOCITY EFFECTS ON DISPERSION IN POROUS MEDIA WITH A SINGLE HETEROGENEITY,
Purdue Univ., Lafayette, IN. School of Chemical Engineering.
For primary bibliographic entry see Field 5B.
W86-05252

ORTHOGONAL-UPSTREAM FINITE ELEMENT APPROACH TO MODELING AQUIFER CONTAMINANT TRANSPORT,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5B.
W86-05256

HELIUM ACCUMULATION IN GROUNDWATER. II: A MODEL FOR THE ACCUMULATION OF THE CRUSTAL 4HE DEGASSING FLUX,
Australian National Univ., Canberra. Research School of Earth Sciences.
T. Torgersen, and G. N. Ivey.
Geochimica et Cosmochimica Acta, Vol. 49, No. 11, p 2445-2452, November 1985. 7 fig, 23 ref.

Descriptors: *Groundwater, *Helium, *Accumulation, Confined aquifers, Aquifers, Confined Groundwater, Degassing, Model Studies, Fluctuations, Mathematical studies, Australia, Namibia.

A model of helium accumulation in a confined aquifer is presented which includes in situ production and a crustal degassing flux of helium into the bottom of a confined aquifer. The in situ production, crustal degassing flux, vertical diffusion coefficient, aquifer thickness, groundwater velocity and a impermeable upper aquiclude were identified as the primary parameters determining the concentration of helium in confined aquifers as a function of vertical and horizontal position (age). The model developed from these parameters was consistent with the measurements of helium concentration in the Great Artesian Basin, Australia and also with that concentration in the Auob Sandstone of Namibia. The measured value of the crustal degassing flux of helium from these two areas is comparable to that calculated from the atmospheric budget of helium. It is concluded that crustal degassing of helium may be a common and widespread phenomenon. (Master-PTT)
W86-05291

MEASUREMENT OF IMPORTANT PARAMETERS DETERMINING AQUEOUS PHASE DIFFUSION RATES THROUGH CRYSTALLINE ROCK MATRICES,
UKAEA Atomic Energy Research Establishment, Harwell (England). Chemistry Div.
For primary bibliographic entry see Field 5B.
W86-05297

UNCONFINED GROUNDWATER FLOW CALCULATION INTO A TUNNEL,
Tahal Consulting Engineers Ltd., Tel-Aviv (Israel). Hydrology Div.
D. Meiri.
Journal of Hydrology, Vol. 82, No. 1/2, p 69-75, November 1985. 5 fig, 1 tab, 4 ref.

Descriptors: *Groundwater movement, *Mathematical analysis, *Tunnels, Numerical model, Water inflow.

A numerical model based on the finite element method for the solution of nonsteady groundwater flow with a free surface is used to analyze the unconfined flow of groundwater into a tunnel. Numerical results are of the same order of magnitude as analytical approximations. Results can be used to estimate the rate of water inflows during tunnel construction, but cannot be used during operation after the tunnel is completed and lined. (McFarlane-PTT)

W86-05298

SINKING CITIES,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 4B.
W86-05321

MULTI-LAYER SAMPLER FOR THE STUDY OF DETAILED HYDROCHEMICAL PROFILES IN GROUNDWATER,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
For primary bibliographic entry see Field 5G.
W86-05336

USE OF RAIN AND DRY DEPOSITION COMPOSITIONS FOR INTERPRETING GROUNDWATER CHEMISTRY,
Arkansas Univ., Fayetteville. Dept. of Geology.
For primary bibliographic entry see Field 2K.
W86-05394

2G. Water In Soils

RELATION BETWEEN L-BAND SOIL EMITTANCE AND SOIL WATER CONTENT,
Agricultural Univ., Wageningen (Netherlands).
For primary bibliographic entry see Field 7B.
W86-04688

PREDICTIONS OF SOIL-WATER POTENTIALS IN THE NORTH-WESTERN SONORAN DESERT,
California Univ., Los Angeles. Dept. of Biology.
D. R. Young, and P. S. Nobel.
Journal of Ecology, Vol. 74, No. 1, p 143-154, March 1986. 2 tab, 6 fig, 38 ref.

Descriptors: *Soil water potential, *Deserts, California, Sonora Desert, Succulents, Computer models, Precipitation, Evaporation, Permeability coefficient.

A computer model was developed to predict soil water potential at a Sonora Desert site near Palm Desert, California, in the southwest United States. The variability of precipitation there, coupled with the low water holding capacity of the sandy soil, resulted in large temporal and spatial variations in soil water potential. The predicted soil water potentials for depths of 5, 10, and 20 cm were in close agreement with measured values as the soil dried after an application of water. Predicted values at a depth of 10 cm, the mean rooting depth of Agave deserti and other succulents common at the study site, also agreed with soil water potentials measured in the field throughout one year. Both soil water potential and evaporation from the soil surface were very sensitive to simulated changes in the hydraulic conductivity of the soil. The annual duration of soil moisture adequate for succulents was dependent on the rainfall as well as on the spacing and amount of individual rainfalls. The portion of annual precipitation evaporated from the soil surface varied from 73 percent in a dry year (77 mm precipitation) to 59 percent in a wet year (597 mm). Simulations were also performed, using the figures for total monthly precipitation. Based on the average number of rainfalls for a particular month, the rainfall was distributed throughout the month in the model. Predictions using both daily and monthly inputs were in close agreement, especially for the number of days during a year when the soil water potential was sufficient for water absorption by the succulent plants. (Peters-PTT)
W86-04695

USING SOIL SURVEY INFORMATION TO CHARACTERIZE THE SOIL-WATER STATE,
Stichting voor Bodemkartering, Wageningen (Netherlands).
J. Bouma.
Journal of Soil Science, Vol. 37, No. 1, p 1-7, March 1986. 3 fig, 24 ref.

Descriptors: *Soil water, *Land evaluation, *Soil survey, *Simulation, *Soil morphology, Bimodal pore systems, Flow subsystems, Hydraulic conductivity, Moisture retention.

The manner in which the soil-water state is characterized in the context of land evaluation is discussed. Current and future developments in land evaluation are discussed, emphasizing the input of soil survey when using computer simulation models for soil water regime. Computer simulation of the soil-water regime can define the potential conditions that professional users of soil information require. Soil morphology, as part of soil survey information, can provide important indications of physical soil properties, but these indications should be treated as hypotheses, not as the final truth. Soil morphology can be used to define representative sample dimensions and sampling locations. Of particular interest are simulation models of soils that have bimodal pore systems where soil morphology is used to define sub-systems of flow, each characterized by the standard flow theory. Pedological differences do not always correspond to functional differences. 'Conversion' of pedological distinctions into functional criteria should be encouraged. This refers to physical measurements of hydraulic conductivity and moisture retention in major soil horizons and use of interpolation techniques such as kriging. (Rochester-PTT)
W86-04713

SORPTION OF TRACE METALS BY HUMIC MATERIALS IN SOILS AND NATURAL WATERS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5B.
W86-04715

POSSIBILITY OF MELIORATION AND AGRICULTURAL USE OF LIMAN AND MARINE SEDIMENTS,
Odessa Agricultural Inst. (USSR).
For primary bibliographic entry see Field 5G.
W86-04729

HEIGHT AND SPEED OF CAPILLARY RISE OF WATER IN MEDIUM LOAM SOILS,
Volga Inst. of Hydraulic Engineering and Melioration, Engel's (USSR).
A. D. Man'ko, L. V. Galibina, and A. S. Fal'kovich.
Soviet Soil Science, Vol. 17, No. 5, p 101-106, September-October, 1985. 2 fig, 2 tab, 8 ref. Translated from Pochvovedeniye, No. 9, p 93-97, 1985.

Descriptors: *Soil water, *Capillarity, *Power functions, *Groundwater discharge, *Medium loam soil, *Aeration, Crop yield, Waterlogging, Salinization, Capillary zone.

Data are presented on the height and speed of the capillary rise of water in lysimeters with 2- and 3-m high monoliths of medium loam soil with a low initial content. Empirical relations in the form of power functions are obtained for the height of the capillary rise of water and the function of time. The 150-cm layer above the water table is the zone of maximum water exchange in medium loam soils. In the presence of mineralized groundwater at this depth, its evaporation in the period between irrigations would lead to the accumulation of salts in the plow layer. The presence of fresh groundwater at this depth would lead to the deterioration of aeration conditions in the soil and reduce crop yield. The height of the capillary rise in soils with a low initial moisture content is directly proportional to the fourth root of time. To prevent the waterlogging and salinization of the soil one must not allow the groundwater to rise above 2.5-3 m. (Rochester-PTT)
W86-04730

DETERMINATION OF THE SOIL WATER BUDGET FROM SUCTION PRESSURE CURVES,
Akademiya Nauk SSSR, Moscow. Pochvennyi Inst.
E. T. Pyagay.
Soviet Soil Science, Vol. 17, No. 5, p 114-120, September-October 1985. 2 fig, 2 tab, 3 ref. Translated from Pochvovedeniye, No. 6, p 131-136.

Descriptors: *Soil water, *Soil water suction, *Infiltration, *Recharge, *Evaporation, *Tensiometers, Irrigation, Rainfall.

Infiltration recharge and evaporation of soil moisture may be determined from suction pressure curves obtained in the field with tensiometers. The proposed method allows rapid determination of the soil saturation by water and makes it possible to calculate the amount of moisture consumed by groundwater during short periods of time under nonstationary moisture transfer conditions. Trials of the method showed that its chief advantage over the moisture-content method is that the data can be obtained quickly for the budget calculations needed to study the water regime of soils in a zone of excessive (or adequate) wetting, where it rains very often in some periods as well as in areas irrigated every 5-10 days. (Rochester-PTT)
W86-04731

DETERMINATION OF THE PARAMETERS OF WATER INTAKE BY SOIL WITH THE ENERGY CHARACTERISTICS OF RAIN TAKEN INTO ACCOUNT,
Moscow Inst. of Agricultural Engineers (USSR).
A. M. Abramov.
Soviet Soil Science, Vol. 17, No. 5, p 121-128, September-October 1985. 2 fig, 3 tab, 9 ref. Translated from Pochvovedeniye, No. 6, p 137-143.

Descriptors: *Irrigation, *Infiltration, *Soil water, *Rainfall impact, *Sprinklers, Soil type, Sandy loam, Chernozems, Alluvial meadow, Bog, Medium clay loam, Soviet soil.

The parameters of water intake by soil may be determined in relation to the energy characteristics of artificial rain. Erosion-permissible irrigation rates for different sprinklers are calculated from the specific power of the rain they produce. The dependency of the erosion-permissible irrigation rate on the specific power of rain is shown for sod on weakly podzolic, medium clay loam; alluvial meadow-bog sandy loam (a soil with a crust); alluvial meadow-bog sandy loam (standard plot); and leached sandy loam chernozem. The disruptive effect of raindrops from sprinkling is considerably decreased in soils that have first been leveled and soaked by rain, in which case a protective layer quickly forms on the soil surface. Erosion-permissible rates of irrigation vary for chernozems in different regions of the Soviet Union. (Rochester-PTT)
W86-04732

EFFECT OF SOIL CHARACTERISTICS ON EROSION AND NUTRIENT LOSS,
Agricultural Research Service, Morris, MN.
For primary bibliographic entry see Field 2J.
W86-04908

NEW METHOD FOR OBTAINING A SPATIALLY AVERAGED INFILTRATION RATE FROM RAINFALL AND RUNOFF RATES,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
S. Y. Campbell, W. H. Van Der Molen, C. W. Rose, and J. Y. Parlange.
Journal of Hydrology, Vol. 82, No. 1/2, p 57-68, November 30, 1985. 2 fig, 14 ref.

Descriptors: *Infiltration rate, *Rainfall rate, *Runoff rate, Rainfall infiltration, Precipitation, Flow rates, Rainfall-runoff relationships, Mathematical analysis.

This paper describes a new method of obtaining a spatial average value for infiltration from rainfall and runoff rates. The theory is developed from the general analytic solution to the kinematic flow approximation of overland flow on a plane surface. Application of the method is illustrated both with analytic examples and field experimental data. The

field data is based on rainfall and runoff measurements from a small catchment on the Walnut Gulch Experimental Watershed in Arizona. Difficulties which appear to have arisen from relative time errors between separate mechanical clocks for rainfall and runoff rates were investigated and overcome using this method. (Khumbatta-PTT)
W86-05074

GEOLOGIC CONTROL ON SOIL COMPOSITION AND PROPERTIES, LAKE OJIBWAY CLAY PLAIN, MATAGAMI, QUEBEC.
McGill Univ., Montreal (Quebec). Geotechnical Research Centre.
Canadian Geotechnical Journal CGJOAH, Vol. 22, No. 4, p 491-500, November 1985. 1 tab, 15 fig, 20 ref.

Descriptors: *Quebec, *Soil physical properties, *Geological control clays, Lake Ojibway, Matagami, Carbonate, Turbidity currents, Glacial geology.

The soft, freshwater varved clays comprising the Ojibway clay plain in the James Bay region of Quebec form the foundation soils for increasing numbers of transportation routes and water retaining structures associated with James Bay hydroelectric development. A knowledge of their behavior over both the short and long term, especially with respect to leaching, is of considerable consequence. Varved clays deposited in proglacial Lake Ojibway at Matagami, Quebec, were derived from two source areas: carbonate-deficient, Precambrian crystalline igneous rocks from New Quebec to the east and carbonate-rich Palaeozoic rocks from the James Bay lowlands in Ontario to the west. About 50% of the 12-15 m thick clay section consists of varved clays containing less than 3% carbonate, reflecting the New Quebec source. The remaining 50% of the section consists of two pulses of carbonate-enriched varves (15-30% carbonate) derived from rock flour in two glacial advances known as Cochrane I and Cochrane II, which advanced to within 20 km of Matagami. The clays are preconsolidated at the site by a combination of desiccation, groundwater level drawdown, and bonding. High in situ water contents correlate with thinner, low-carbonate, distal varves of high activity. The best correlations are obtained for relative activity. Carbonate seems to have effectively neutralized smectite in the Cochrane proximal varves, rendering the distal varves (of New Quebec source) the most active clays at the site. (Peters-PTT)
W86-05103

DETERMINATION OF SATURATED HYDRAULIC CONDUCTIVITY FROM SOIL PERCOLATION TEST RESULTS,
Oxford Univ. (England).
D. D. Fritton, T. T. Ratvasky, and G. W. Petersen.
Soil Science Society of America Journal, Vol. 50, No. 2, p 273-276, March/April 1986.

Descriptors: *Hydrology, *Soil water, *Percolation, *Permeability coefficient, Infiltration rate, Pennsylvania, Linear regression analysis, Hydraulic permeability, Soil types.

Percolation times and saturated hydraulic conductivity rates from 28 test holes were used with data from the literature to relate saturated hydraulic conductivity, K, to percolation time, P. Sites were chosen to represent seven central and western Pennsylvania soils developed in shale and sandstone colluvium, alluvium, glacial outwash, or residual limestone parent materials. The sites used included Murrill, Hagerstown, Lindside, Morrison, Clarksburg, and Conotton. Saturated hydraulic conductivity was determined by the shallow well pump-in method, an in situ test that measured three dimensional water flow into the soil. Percolation time was determined using a modification of approved procedures of the EPA and the Pennsylvania Department of Environmental Resources. Linear regression analysis performed on the base 10 logarithm of the 28 pairs of data resulted in the equation: log K= -0.309 log P-4.296 (with P in units of s/m and K in units of m/s). This equation was compared to one from literature data and to a steady state three dimensional infiltration equation derived from soil water flow theory. The literature data and the theoretical equation were different from that generated in this study due to the use of a saturated hydraulic conductivity technique that was sensitive to the layered nature of the soils used. (Peters-PTT)
W86-05124

LEACHING OF HERBICIDES THROUGH UNDISTURBED CORES OF A STRUCTURED CLAY SOIL,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 5B.
W86-05125

EVAPORITE MINERALOGY ASSOCIATED WITH SALINE SEEPS IN SOUTHWESTERN NORTH DAKOTA,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 3C.
W86-05128

WATER TABLE OF ALDER AND NEIGHBOURING ELM STANDS IN A SMALL TRIBUTARY BASIN,
Tohoku Univ., Sendai (Japan). Biological Inst.
For primary bibliographic entry see Field 2I.
W86-05188

EFFECTS OF MOISTURE ON SOIL MICROORGANISMS AND NEMATODES: A FIELD EXPERIMENT,
Sveriges Lantbruksuniversitet, Uppsala. Institutionen foer Mikrobiologi.
J. Schnurer, M. Clarholm, S. Bostrom, and T. Rosswall.
Microbial Ecology MCBEBU, Vol. 12, No. 2, p 217-230, June 1986. 10 fig, 1 tab, 28 ref.

Descriptors: *Soil moisture, *Rainfall impact, *Nematodes, Irrigation, Agriculture, Biomass, Protozoa, Oxygen consumption, Bacteria, Cultivated lands, Soil fungi, Soil bacteria, Fungi.

The short-term dynamics of various soil organisms under two different moisture regimes were compared. Agricultural soil was examined for the effects of a single rainfall event and subsequent drying, and was compared to a soil kept moist by daily irrigation. Numbers and biomass of bacteria, numbers of protozoa and nematodes, length of FDA-active hyphae, and total hyphal lengths were determined at daily intervals. Oxygen consumption was determined to obtain an integrated measure of biological activity. Total hyphal length was not affected by one rainfall but increased from 700 m/gm dry weight soil, to more than 1,600 m in less than ten days in the irrigated plot. In the rain plot, bacterial numbers doubled within 3 days and declined during the following period of drought. In the irrigated plot, numbers increased by 50% and then remained constant over the duration of the study. Only small changes in protozoan numbers were observed, with the exceptions of the last sampling date in the irrigated plot when large numbers of naked amoebae were recorded 2 days after a large natural rainfall. Nematode numbers, especially obligate root feeders, increased in both treatments. The increases were caused by decoiling rather than growth. The results indicate that fungal respiration was dominating, while bacteria, lacking a suitable source of energy, were less active, except for the first days. (Peters-PTT)
W86-05203

SECOND-ORDER APPROACH FOR THE MODELING OF DISPERSIVE TRANSPORT IN POROUS MEDIA: 1. THEORETICAL DEVELOPMENT,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-05205

SECOND-ORDER APPROACH FOR THE MODELING OF DISPERSIVE TRANSPORT IN POROUS MEDIA: 2. APPLICATION TO SOLUTE MOTION IN PIPES AND CAPILLARY TUBES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-05206

DRAINAGE FROM A UNIFORM SOIL LAYER ON A HILLSLOPE,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
For primary bibliographic entry see Field 2E.
W86-05209

INVESTIGATION OF WATER MOVEMENT IN THE UNSATURATED ZONE UNDER AN IRRIGATED AREA USING ENVIRONMENTAL TRITIUM,
Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotope Research.
H. Gvirtzman, and M. Magaritz.
Water Resources Research WRERAO, Vol. 22, No. 5, p 635-642, May 1986. 4 fig, 4 tab, 49 ref.

Descriptors: *Unsaturated flow, *Soilwater movement, *Soil water, *Aeration zone, *Tritium, Groundwater movement, Irrigation water, Convection, Percolation, Precipitation, Flow rates, Flow profile, Loess, Negev, Israel, Radioisotopes.

A 14-year record of convective-dispersive flow in the unsaturated zone was reconstructed using the difference between the environmental tritium content of rain, and that of irrigation water. Samples were taken from a loess profile in the northern Negev, Israel, in an area where precipitation is 200 mm/winter and irrigation is 650 mm/summer. The difference between the measured tritium profile and the input tritium profile was interpreted in terms of mobile and immobile water domains. The percentage of the total water which remained immobile was estimated to be about 40% at the surface and 55% at 8.5 m depth. This leads to the estimate that 8 + 1% of the rain and irrigation water percolated downward, with a velocity of 0.66 + 0.03 m/yr, and a maximal effective dispersion coefficient of 5 times 10 to the -11 sq m/s. Using these values, the limits of dispersivity (0.5-1.5mm) and of tortuosity (0.05-0.11) were determined, in the medium studied. (Lantz-PTT)
W86-05210

FIELD STUDY OF NAPROPAMIDE MOVEMENT THROUGH UNSATURATED SOIL,
California Univ., Riverside. Dept. of Earth Sciences.
For primary bibliographic entry see Field 5B.
W86-05221

PREDICTION OF SURFACE SATURATION ZONES IN NATURAL CATCHMENTS BY TOPOGRAPHIC ANALYSIS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
For primary bibliographic entry see Field 2E.
W86-05226

DIFFERENTIAL BARE FIELD DRAINAGE PROPERTIES FROM AIRBORNE MICROWAVE OBSERVATIONS,
Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
R. Bernard, J. V. Soares, and D. Vidal-Madjar.
Water Resources Research WRERAO, Vol. 22, No. 6, p 869-875, June 1986. 5 fig, 3 tab, 26 ref.

Descriptors: *Drainage patterns, *Microwaves, *Aerial photography, Remote sensing, Soil moisture, Measuring instruments, Model studies, Evaporation, Mathematical analysis.

Time variations of surface soil moisture can be monitored using active microwave remote sensing. With the existence of airborne systems, it is now

possible to estimate this variable on a regional scale. Data from a helicopter-borne scatterometer show that surface water content reductions during a 9-day period are quite different from one field to another. A simple model describing the water budget of the soil surface layer due to evaporation and drainage is applied. From this model, a pseudodiffusivity can be calculated for each field using only the remotely sensed data. This new parameter gives a quantitative estimate of the observed drying heterogeneities. (Lantz-PTT)
W86-05245

SOIL WATER EXTRACTOR THAT MINIMIZES CO2 DEGASSING AND PH ERRORS,
D. L. Suarez.
Water Resources Research WRERAO, Vol. 22, No. 6, p 876-880, June 1986. 5 fig, 1 tab, 6 ref.

Descriptors: *Soil water, *Sampling, *Water extractors, *Carbon dioxide, *Hydrogen ion concentration, Measuring instruments, Minerals, Chemical precipitation.

Soil water extractors that are presently used to sample the unsaturated zone cause substantial CO2 degassing within the sampler, resulting in pH errors that are sufficiently large to create measured pH values that are unacceptable for determining specific mineralogic controls on solution composition. The pH increases can also result in oxide and carbonate precipitation within the extractor thereby altering solution composition. The soil water samplers described here reduce CO2 degassing by minimizing the gas-liquid ratio in the extractor and by flushing several volumes of solution through the liquid-filled sampling container before a sample is removed. The construction of both shallow and deep samplers is described. (Lantz-PTT)
W86-05246

SOIL WATER MOVEMENT AND RECHARGE THROUGH SAND AT A SEMIARID SITE IN NEW MEXICO,
New Mexico Inst. of Mining and Technology, Socorro. Dept. of Geoscience.
D. B. Stephens, and R. Knowlton, Jr.
Water Resources Research WRERAO, Vol. 22, No. 6, p 881-889, June 1986. 7 fig, 4 tab, 29 ref. New Mexico Water Resources Research Institute Grant Program Project 1345679.

Descriptors: *Soil water, *Recharge, *Sand, *Semiarid lands, *New Mexico, Socorro, Groundwater recharge, Groundwater movement, Seasonal variations, Vertical flow, Hydraulic conductivity, Pressure head.

A semiarid site near Socorro, New Mexico, has been instrumented with tensiometers and a neutron probe access tube to study soil water movement which may contribute to areal groundwater recharge under natural conditions. During the period of record which extends from November 1982 through May 1984, annual precipitation was approximately 17.9 cm/yr. Below a depth of about 30 cm, pressure head ranged from about -129 to -35 cm and moisture content varied between about 0.05 to 0.09 cu cm/cu cm. The vertical hydraulic gradient was slightly greater than unity and indicated downward soil water movement. Unsaturated hydraulic conductivity was determined in the field by the instantaneous profile method. Recharge was calculated from Darcy's equation using in situ pressure head data below the root zone, calculated hydraulic gradient, and in situ hydraulic conductivity. Recharge was also calculated as being equal to the unsaturated hydraulic conductivity corresponding to in situ water content. Average annual recharge calculated over a 19 month period from pressure head measurements may range from 0.7 cm/yr to as much as 3.7 cm/yr. Recharge estimated from moisture-content data, assuming a unit hydraulic gradient, is about 3.7 cm/yr. During the period of record, monthly average recharge varies by more than 3 orders of magnitude. Both the winter frontal storms and intense summer thunderstorms lead to deep infiltration, and presumably, groundwater recharge. (Lantz-PTT)
W86-05247

EQUIVALENT FORMULATIONS FOR SOLUTE AND WATER MOVEMENT IN SOILS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
C. J. Barnes.
Water Resources Research WRERAO, Vol. 22, No. 6, p 913-918, June 1986. 7 fig, 1 tab, 15 ref.

Descriptors: *Mathematical equations, *Solute transport, *Path of pollutants, *Soil water, Saturated soils, Unsaturated flow, Saturated flow, Mathematical models.

The equivalence between certain formulations of equations describing solute movement through saturated soils and water movement in unsaturated soils, is used to infer results about solute movement from known results concerning saturated water movement, and vice versa. This equivalence is shown to extend to multidimensional solute movement. By analogy with a quasi-analytical theory of water movement in unsaturated soils, the concept of the solute flux-concentration relation is introduced. The examples of the usefulness of the equivalence between the two sets of equations are instructive, but by no means exhaust the possibilities. In particular, the restrictive conditions of a constant convective velocity and uniform water content for solute movement can be removed. (Lantz-PTT)
W86-05251

SEASONAL AND DIURNAL VARIATION OF ENERGY BUDGET COMPONENTS IN CONIFEROUS FORESTS,
Sveriges Lantbruksuniversitet, Uppsala. Inst. foer Ekologi och Miljoevaard.
For primary bibliographic entry see Field 2D.
W86-05296

2H. Lakes

RAISED BOGS OF SOUTH-EASTERN LABRADOR, CANADA: CLASSIFICATION, DISTRIBUTION, VEGETATION AND RECENT DYNAMICS,
Harvard Univ., Petersham, MA. Harvard Forest.
D. R. Foster, and P. H. Glaser.
Journal of Ecology, Vol. 74, No. 1, p 47-71, March 1986. 3 tab, 15 fig, 75 ref.

Descriptors: *Bogs, *Canada, Labrador, Mires, Hummock vegetation, Peatland zonation, Precipitation.

A general classification of the mire types and vegetation in southeastern Labrador was provided and the factors responsible for the zonal distribution were investigated. The mires of Labrador form a distinct geographical zonation: concentric raised bogs occur at low altitudes along the southern coast, excentric and plateau bogs extend inland to slightly greater altitudes and higher latitudes, and patterned fens occupy most of the interior north to the tundra. Labrador belongs politically to the Province of Newfoundland and, geographically, occupies a portion of the Labrador-Ungava Peninsula, which it shares with the Province of Quebec. The zone boundaries parallel contours and climatic isopleths, and the zonation is explained in terms of the effects of moisture surplus, soligenous water flow and physiography on mire development. The raised bogs are similar to oceanic mires, with an extensive ground cover of Cladonia spp., absence of trees on the mire expanse, and pronounced surface patterns of broad peat hummocks and open water pools. The recent history of the hummock vegetation involves the alteration of Cladonia stellaris and Sphagnum fuscum, as documented by the presence of recurrence surfaces in short cores, peat monoliths, and long cores. Local factors, including fire and the lowering of the water table through pool drainage, are frequently responsible for changes in the ground cover and the degree of peat humification, and they may confound the stratigraphic interpretation of climatic change. (Peters-PTT)
W86-04693

GERMINATION OF TEN SHORELINE PLANTS IN RELATION TO SEED SIZE, SOIL PARTICLE SIZE AND WATER LEVEL: AN EXPERIMENTAL STUDY,
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 2I.
W86-04694

DISTRIBUTION OF EPIPHYTIC BACTERIA ON FRESHWATER PLANTS,
Freshwater Biological Association, Wareham (England). River Lab.
J. H. Baker, and D. R. Orr.
Journal of Ecology, Vol. 74, No. 1, p 155-165, March 1986. 2 tab, 3 fig, 28 ref.

Descriptors: *Aquatic plants, *Epiphytic bacteria, Leaf surface community.

The population densities of bacteria on the leaves of a range of aquatic plant species were determined, including differences both within and between leaves of the same plant. The spatial distribution of epiphytic bacteria was determined on Apium nodiflorum (L.) Lag., Elodea canadensi Michx., Glyceria maxima (Hartm.) Holmberg, Glyceria Maxima (Hartm.) Holmberg, Nasturtium officinale R. Br., and Veronica beccabunga L. The proportion of the total variance due to the variance between leaves ranged widely (0.04 to 0.82). Two species (Nasturtium officinale and Veronica beccabunga) had significantly larger populations on the abaxial surfaces of their submerged leaves than on the adaxial surfaces of the same leaves. The older the leaf, the greater was the bacterial density. The aerial parts of floating and emergent plants had substantially lower bacterial densities than the submerged parts. No significant seasonal differences were discernible between leaves of the same age, but significant short term changes were detected on Ranunculus penicillatus var. calcareus. (Peters-PTT)
W86-04696

FROM SWAMP TO LAKE: RECENT CHANGES IN A LOWLAND TROPICAL SWAMP,
Papua New Guinea Univ., Port Moresby. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W86-04697

NITROGEN CYCLING IN A FRESHWATER MARSH OF PANICUM HEMITOMON ON THE DELTAIC PLAIN OF THE MISSISSIPPI RIVER,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
R. D. DeLaune, C. J. Smith, and M. N. Sarafyan.
Journal of Ecology, Vol. 74, No. 1, p 249-256, March 1986. 2 fig, 1 tab, 26 ref.

Descriptors: *Marshes, *Freshwater marshes, *Nitrogen Cycle, Mississippi River, *Deltaic plain, Louisiana, Nitrogen fixation.

The response of Panicum hemitomon to added nitrogen was determined and the major nitrogen fluxes including fixation and losses from a P. hemitomon freshwater marsh were measured. The marsh bordered Lac des Allemandes, a 65 sq km freshwater lake in the northern part of Barataria Basin located along the deltaic plain of the Mississippi River. P. hemitomon is the predominant freshwater plant in these marshes, a large percentage of which are floating marsh or flotant and contain a mat of roots and plant remains overlying an unconsolidated peat layer 0-35 cm thick, underlain by 1-5 m of organic ooze which grades with depth to clay. Nitrogen is apparently a limiting nutrient since supplemental nitrogen increased above ground biomass by 40 percent. There is apparently little loss of internal nitrogen from the system since 80 percent of the nitrogen added at the rate of 3 grams per sq m was recovered in the soil plant system at the end of the growing season. Nitrogen fixation was the principal source of nitrogen to this vast freshwater system with 6.7 grams per sq m per year being added. These marshes are apparently serving as large nitrogen sinks, with 12 grams per sq m per year being retained as organic

nitrogen as a result of accretion as determined by 137Cs dating. The results suggest that these freshwater marshes may improve water quality by removing nutrients from inflowing water. (Peters-PTT)
W86-04698

USE OF LAMINATED LAKE SEDIMENTS IN THE ESTIMATION AND CALIBRATION OF EROSION RATES,
Plymouth Polytechnic (England). Dept. of Environmental Sciences.
P. E. O'Sullivan, M. A. Coard, and D. A. Pickering.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 385-396, 3 fig, 3 tab, 34 ref.

Descriptors: *Erosion rates, *Lake sediments, *Drainage area, *Deposition, Erosion, Laminated sediments, England, Cores, Sedimentation, Lagoons, Cornwall, Loe Pool, Cober River.

The value of lake sediments as a potential source of information for the study of the ontogeny of drainage basins is considered, and the importance of this information to geologists and geomorphologists is discussed. In particular, the laminated sediments known as clastic varves, which are composed mainly of allochthonous material, afford an excellent opportunity for the study of erosion rates. The clastic varves of Loe Pool, a coastal lagoon in Cornwall (United Kingdom), have been used to study erosion rates in the basin for the River Cover in the period from approximately 1860 to the present. Multiple coring of the most recent sediments was used to calculate volume, mass and influx of dry matter and ash to the pool during periods of intensive mining, and the subsequent post-mining period. Erosion rates were found to be approximately 174 t/km/yr in the late nineteenth century, between 360 and 420 t/km/yr during the early twentieth century, and approximately 12 t/km/yr at present. (See also W86-04896) (Halterman - PTT)
W86-04933

HYDROTHERMAL-BIOLOGICAL COUPLING OF LAKE EUTROPHICATION MODELS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
For primary bibliographic entry see Field 5C.
W86-04938

LAKE RESTORATION: A FIVE-YEAR EVALUATION OF THE MIRROR AND SHADOW LAKE PROJECT WAUPACA, WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison.
For primary bibliographic entry see Field 5G.
W86-04939

NATURAL FLOW VISUALIZATION IN LAKE EYRE, SOUTH AUSTRALIA,
Flinders Univ. of South Australia, Bedford Park. School of Earth Sciences.
J. A. T. Bye, R. A. D. Byron-Scott, T. Maxworthy, and R. A. Nunes.
EOS, Transactions, American Geophysical Union, Vol. 67, No. 5, p 58-59, February 4, 1986. 3 fig, 1 tab, 6 ref.

Descriptors: *Flood, *Flow pattern, *Water currents, *Waves, *Aerial reconnaissance, Flow around objects, Lake Eyre, South Australia, Fine silt, Dissolved salt.

A rare flooding event occurring in Lake Eyre, South Australia, permitted visualization of flow patterns. This is possible because a sharp boundary persists between dissolved gypseous salt (from the bottom of the lake when dry) and fine silt, which is suspended from elsewhere in the lake. Aerial observations were conducted of the following phenomena: (1) a series of nearly two-dimensional rollers or breaking waves, which occurs on the southern interface between and the silty water in the lee of the sand islands and the clear water that is flowing along the coastal channel; (2) an injection of clear water over a low sand bar into silty water, a distance of 600 m, which shows a series of fine entrainment features and an asymmetric head; and (3) a family of quasi-horizontal intrusions, through which the silty water was interleaving with the clear water across the northern interface in the lee of the islands. (Rochester-PTT)
W86-04981

DECLINING LAKE SEDIMENT PHOSPHORUS RELEASE AND OXYGEN DEFICIT FOLLOWING WASTEWATER DIVERSION,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W86-05025

MONITORING SEBAGO LAKE WATER QUALITY BELOW THE THERMOCLINE,
Portland Water District, ME.
For primary bibliographic entry see Field 5F.
W86-05027

STUDIES OF DIURNAL ACID FLUCTUATIONS IN BRITISH ISOETID-TYPE SUBMERGED AQUATIC MACROPHYTES,
Saint Andrews Univ. (Scotland). Dept. of Plant Biology and Ecology.
For primary bibliographic entry see Field 5C.
W86-05064

SUCCESSION OF COMMUNITIES IN THE GOCZALKOWICE DAM RESERVOIR IN THE PERIOD 1955-1982,
Polish Academy of Sciences, Goczalkowice. Hydrobiological Station.
E. Krzyzanek, H. Kasza, W. Krzanowski, T. Kuflikowski, and G. Pajak.
Archiv fuer Hydrobiologie AHYBAY, Vol. 106, No. 1, p 21-43, 1986. 7 fig, 3 tab, 49 ref.

Descriptors: *Reservoirs, *Ecosystems, *Goczalkowice Dam, Poland, Lake morphology, Aquatic plants, Aquatic animals, Aquatic life, Aquatic environment.

The dam reservoir at Goczalkowice was constructed in the years 1950-1955, as a water intake for community supply and for retention. Thanks to the hydrological investigations carried out continuously from the filling of the reservoir, the process of biocenotic formation and the succession of plant and animal organisms could be examined against the background of changes in the chemical composition of the water. In the 28 years of the reservoir's existence five stages of biocenotic formation were differentiated against the background of changes in the chemical constituents of the water. In the first stage, just after damming, riverine and land biocenoses were destroyed. Three months after the filling of the reservoir the second stage began, taking about two months; the period of initial formation of biocenoses in the reservoir. The third period, dating from 1956 to the early sixties, was still characterized by a poor chemical and biological stabilization. The dynamic development of plankton, benthos, and mycrophytes was noted. The fourth stage, from the early sixties to the beginning of the seventies, can be termed 'oligotrophication' period in the development of the reservoir. The biocenoses were finally formed, while their quantitative composition deteriorated. The fifth stage, started at the beginning of the seventies and still continues. The fertility of the reservoir, the concentration of calcium, magnesium, chlorides, and sulfates, and of nutrients increased. This was manifested by the more intensive development of plants and animals, especially of phytoplankton with blooms of Microcystis aeruginosa. (Lantz-PTT)
W86-05084

SIGNIFICANCE AND DEGREE OF ABIOSESTON CONSUMPTION IN THE FILTER-FEEDER DAPHNIA GALEATA SARS AM. RICHARD (CLADOCERA) IN LAKE BALATON,
Balatoni Limnologiai Kutato Intezete, Tihany (Hungary).
For primary bibliographic entry see Field 5B.
W86-05085

INVESTIGATIONS ABOUT THE FATE OF HEAVY METALS IN LAKES: II. THE ROLE OF IRON AND MANGANESE REMOBILIZATION TO THE HYPOLIMNIC ENRICHMENT OF HEAVY METALS (UNTERSUCHUNGEN ZUM VERHALTEN VON SCHWERMETALLEN IN GEWASSERN: II. DIE BEDEUTUNG DER EISEN- UND MANGAN-REMOBILISIERUNG FUER DIE HYPOLIMNISCHE ANREICHERUNG VON SCHWERMETALLEN),
Technische Univ. Berlin (Germany, F.R.). Inst. fuer Technischen Umweltschutz.
For primary bibliographic entry see Field 5B.
W86-05088

DIAGNOSTIC STUDY ON THE VERTICAL CIRCULATION AND THE MAINTENANCE MECHANISMS OF THE CYCLONIC GYRE IN LAKE BIWA,
Shiga Univ., Otsu (Japan). Dept. of Earth Science.
S. Endoh.
Journal of Geophysical Research, Vol. 91, No. C1, p869-876, January 15, 1986. 1 tab, 8 fig, 27 ref.

Descriptors: *Cyclonic gyre, *Limnology, *Vertical circulation, *Lake Biwa, Thermal stratification, Downwelling, Upwelling, Differential heating, Seasonal variation, Mathematical models, Japan, Lakes.

The physical significance of vertical circulation and evidence for its existence in Lake Biwa, Japan, are shown, and some maintenance mechanisms of the gyre are discussed on the basis of a previously developed diagnostic model and observed water temperature distributions. Lake Biwa, the largest lake in Japan has a stable cyclonic gyre during seasons of thermal stratification. A vertical circulation consisting of downwelling in the central area and upwelling near the rim of the gyre is calculated by the diagnostic model. The energetics in the model indicate that this vertical circulation corresponds to the decay process of the gyre. Tracking of drifters in summer supports the presence of a vertical circulation, though its magnitude is about 50% less than that estimated by the diagnostic model. This is explained from the ratio of kinetic energy and available potential energy of the gyre. The realistic value of the vertical eddy viscosity is estimated to be 0.8-2.1 sq cm/s in summer. Monthly variations of the horizontal and vertical circulations are calculated by the diagnostic model using the monthly mean density fields. The gyre and the vertical circulation are maximal in September. The characteristic decay time scale of the gyre is estimated to be about 10 days. The effect of topographic differential heating is one of the maintenance mechanisms of the gyre in early summer, and from late summer to late fall. (Peters-PTT)
W86-05094

MODEL OF GAS TRANSFER ACROSS AIR-WATER INTERFACES WITH CAPILLARY WAVES,
Aix-Marseille-1 Univ. (France). Inst. de Mecanique Statistique de la Turbulence.
M. Coantic.
Journal of Geophysical Research, Vol. 91, No. C3, p 3925-3943, March 15, 1986. 2 tab, 10 fig, 70 ref.

Descriptors: *Capillary waves, *Air-water interfaces, *Mathematical models, Gas transfer, Wind velocity, Schmidt number, Lakes, Eddy diffusion, Hydrodynamics.

The transfer of weakly soluble gases between the atmosphere and seas or lakes is controlled by liquid-phase molecular and turbulent diffusion mechanisms, which depend on wind velocity and gas Schmidt number. A distinct change in regime is observed around 2-3 m/s, when capillary waves appear, which present models cannot explain. It is suggested that turbulent diffusivity be related with

(1) possible motions close to a free liquid-gas interface, (2) mean current distribution in that region, and (3) capillary wave spectra. Resulting transfer velocities explain laboratory and field data at low and moderate wind speeds. A mathematical model was developed that led to a prediction of gas exchange coefficient as a function of interfacial friction, in the wind speed range where wave breaking is not important. This was done from purely hydrodynamical considerations and data, without recourse to any adjustment of a constant from gas exchange data. The predicted exchange rates, however, are in quantitative agreement with the best available experimental results. The present approach provides a satisfactory qualitative explanation for the important amount of scatter shown by observations. (Peters-PTT)
W86-05099

CLIMATOLOGY OF INTERNAL WAVES IN A DEEP TEMPERATE LAKE,
National Water Research Inst., Vancouver (British Columbia).
R. C. Wiegand, and E. C. Carmack.
Journal of Geophysical Research, Vol. 91, No. C3, p 3951-3958, March 15, 1986. 14 fig, 34 ref.

Descriptors: *Seiches, *Internal waves, *Climatology, *Lakes, Kootenay Lake, British Columbia, Thermistor chains, Wind, Seasonal variation, Thermal stratification, Hydrodynamics, Waves.

The internal motions in a large temperate lake are examined from the viewpoint of wave climatology. Kootenay Lake is a long (100 km), deep (140 m), dimictic lake in southeastern British Columbia. Internal waves were observed over an 18-month period using three thermistor chains moored along the major axis of the lake. To characterize their seasonal aspects, four types of oscillations are recognized: classical seiches with amplitudes of 10-30 m and periods of 1-2 weeks, intrabasin waves with periods of 2-4 days, large-amplitude waves resembling nonlinear surges, and high-frequency waves associated with both the internal surge and large-amplitude internal seiche motions. The periods of the major components of the internal wave field are determined mainly by morphometry but vary seasonally with stratification. Thus the wind, which not only forces internal waves but can also modify stratification, is important. In large lakes like Kootenay, the thermal structure may vary not only spatially but also temporally at periods comparable to those of the internal waves themselves. Hence the shape and frequency of these waves may be altered as they pass through the lake. Large amplitudes occur during spring and late autumn when stratification is weak. (Peters-PTT)
W86-05100

CATASTROPHIC LAKE DRAINAGE WITHIN THE HOMATHKO RIVER BASIN, BRITISH COLUMBIA,
British Columbia Hydro and Power Authority, Vancouver. Geotechnical Dept.
I. Blown, and M. Church.
Canadian Geotechnical Journal CGJOAH, Vol. 22, No. 4, p 551-563, November 1985. 1 tab, 12 fig, 20 ref.

Descriptors: *Lakes, *British Columbia, *Drainage, Homathko River, Dam break, Debris flow, Hazard evaluation, Jokulhlaup, Floods, Lake ice, Moraines.

Three examples of sudden lake drainage and some potentially dangerous situations, encountered in the Homathko River basin within the Coast Mountains of British Columbia, Canada are presented. Some simple reconnaissance methods used to assess potential hazard presented by a lake are evaluated. To understand the mechanism of failure and gain information about the probability of further catastrophic drainages, ground reconnaissance was necessary at each site. The three phenomena related to sudden lake drainage include: moraine breaching by solitary wave action following an icefall into a lake; failure of a glacier ice dam by flotation and melting to produce a glacier outburst flood or jokulhlaup; and debris torrent following a moraine breach. The possibility of a fourth phenomenon, moraine failure by piping, is discussed. A first attempt to develop practical hazard evaluation methods before the event, which relies on simple scale relations or index relations developed from experience of events elsewhere, is presented. (Peters-PTT)
W86-05104

EUTROPHICATION IN NORTHERN TUNISIA,
Deutsche Gesellschaft fuer Technische Zusammenarbeit G.m.b.H., Eschborn (Germany, F.R.).
For primary bibliographic entry see Field 5C.
W86-05150

CLEARANCE RATES OF CRUSTACEAN MACROFILTRATORS: THE NATURE OF IN SITU RATE DEPRESSIONS IN A FERTILIZED OLIGOTROPHIC LAKE IN THE KUOKKEL AREA, NORTHERN SWEDEN,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
For primary bibliographic entry see Field 5C.
W86-05154

AVAILABILITY OF PHOSPHORUS AND THE SPECIES COMPOSITION OF THE SPRING PHYTOPLANKTON IN LAKE ERKEN,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
For primary bibliographic entry see Field 5C.
W86-05156

PRIMARY PRODUCTION AND EFFECTS OF ENRICHMENT WITH NITRATE AND PHOSPHATE ON PHYTOPLANKTON IN THE BARRA BONITA RESERVOIR (STATE OF SAO PAULO, BRAZIL),
Universidade Federal de Sao Carlos (Brazil). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W86-05157

EPIPELIC ALGAL FLORA OF THE RIVER WYE SYSTEM, WALES, UK. 1. PRODUCTIVITY AND TOTAL BIOMASS DYNAMICS,
University Coll., Cardiff (Wales). Dept. of Plant Science.
S. E. Antoine, and K. Bensen-Evans.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 4, p 575-589, 1985. 3 tab, 6 fig, 31 ref.

Descriptors: *Biomass, *River Wye, *Algal growth, *Productivity, *Wales, Chlorophyll, Algae, River Elan, River Iteron, River Lugg, Temperature effects, Seasonal variation, Benthos.

The spatial and temporal distribution of the epipelic algal flora of the non-tidal sections of the River Wye and its tributaries, the Rivers Elan, Ithon and Lugg were investigated. Chlorophyll-alpha and productivity values showed a downstream increase, which was much less obvious for the total biomass. Phaeophytin-alpha values followed almost similar spatial and temporal fluctuations to those of chlorophyll-alpha. High chlorophyll-alpha productivity and total biomass values were recorded during warmer months due to favorable environmental conditions for algal growth. These parameters had lower values during unfavorable winter and flood periods. A drop in the numbers of epipelic algae seen during early autumn after a period of high standing crop and low water levels may be due to a high level of metabolic activity or to grazing by the zoobenthos during the warmer months. The decreased algal population during the winter months is attributed to the short day length, lower temperature and higher flow rates.)
W86-05158

ANALYSIS OF THE BIOTIC COMMUNITY IN A KUMAUN HIMALAYAN LAKE, NAINITAL (U.P.), INDIA,
Kumaun Univ., Naini Tal (India). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W86-05159

MEASURE OF PLANKTON COMMUNITY SIMILARITY UTILIZING VARIABLE WEIGHTING OF TOTAL DENSITY AND TAXONOMIC PROPORTIONALITY,
Ontario Ministry of the Environment, Rexdale.
K. H. Nicholls.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 5, p 621-632, 1985. 8 tab, 4 fig, 17 ref.

Descriptors: *Ecosystems, *Plankton, *Mathematical analysis, Taxonomy, Gravenhurst Bay, Ontario, Phosphorus removal, Limnology, Algae, Species diversity, Phytoplankton, Phosphorus removal.

Four commonly used formulae for measuring percentage similarity (PS) of biological communities were tested for their usefulness in relating to two plankton community properties, species proportional differences and total density differences. The method was applied to phytoplankton data from Gravenhurst Bay, Ontario, where phosphorus loading reductions have resulted in significant changes in the phytoplankton community. The new expression involves a seven step procedure for organizing and arithmetically manipulating plankton data for calculations of PS. Any desired weighting factor may be applied to emphasize either the proportionality of species content or the total density properties of the plankton assemblages. The expression, as applied to the phytoplankton data from Gravenhurst Bay, used equal weighting of the taxonomic and total density properties. The phytoplankton data were organized as ice-free period average biomass values for the dominant algal classes and functional groups (i.e., blue-green bloom formers, blue-green nonbloom formers, and five other algal classes). The new expression of PS clearly showed a better distinction between phytoplankton communities pre- and post phosphorus control, than could be shown with another measure of PS measuring only similarity of taxonomic structure. (Peters-PTT)
W86-05160

CHEMICAL AND MICROBIOLOGICAL PROCESSES AS REGULATORS OF THE EXCHANGE OF SUBSTANCES BETWEEN SEDIMENTS AND WATER IN SHALLOW EUTROPHIC LAKES,
Swedish Environmental Research Inst., Stockholm.
For primary bibliographic entry see Field 5C.
W86-05161

JUVENILE ANADROMOUS ATLANTIC SALMON OF THREE LAKES OF NEWFOUNDLAND,
Department of Fisheries and Oceans, St. John's (Newfoundland). Fisheries Research Branch.
V. A. Pepper, N. P. Oliver, and R. Blundon.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 5, p 733-753, 1985. 4 tab, 8 fig, 55 ref.

Descriptors: *Lakes, *Salmon, Lentic environment, Gander River, Newfoundland, Bonavista Bay, Deep water, Shallow water.

Anadromous Atlantic salmon parr (Salmo salar) were captured from these Newfoundland lakes: Salmon Pond on the Gander River system, Indian Pond on the Indian Brook system, and Butts Pond on the Middle Brook system. The first two systems empty into Notre Dame Bay on the northeast coast of Newfoundland. Middle Brook empties into Bonavista Bay in the vicinity of the community of Gambo. The lakes were examined to determine the extent to which lentic habitats are used as nursery areas for natural populations of these salmon. The observed standing stock of juvenile salmon in the lakes studied, varied inversely with mean lake depth. Growth rate of parr in lacustrine habitat was > or = that of parr in riverine habitats in the same watersheds. Yearling and 2 year parr were captures most often in shallow water <2 meters deep around the lake perimeters and were not abundant at greater depths. The 3+ and 4+ parr age groups were rarely found inshore but were captured in deeper offshore areas. No under year-

lings were found in lake habitats. It is concluded that some shallow lakes of Newfoundland provide major rearing areas for juvenile anadromous Atlantic salmon. (Peters-PTT)
W86-05163

COMPARATIVE LIMNOLOGY OF SEVERAL RESERVOIRS IN CENTRAL INDIA,
Government Post Graduate Coll., Chhindwara (India). Dept. of Botany.
For primary bibliographic entry see Field 5C.
W86-05164

LIMNOLOGICAL OBSERVATIONS ON RIHAND RESERVOIR (UTTAR PRADESH) WITH REFERENCE TO THE PHYSICAL AND CHEMICAL PARAMETERS OF ITS WATER,
Central Inland Fisheries Research Inst., Merzapur (India). All-India Coordinated Research Project on Ecology and Fisheries of Freshwater Reservoirs.
R. K. Singh.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 6, p 857-875, 1985. 12 tab, 12 fig, 24 ref.

Descriptors: *Reservoirs, *Thermocline, *Limnology, *Nutrients, *Rihand Reservoir, Phytoplankton, River Rihand, Uttar Pradesh, River Stone, Ganges River, Monsoon, Catchment areas, Limnology, Evaporation, Temperature effects, Rainfall, Hydrogen ion concentration, Dissolved oxygen, Transparency, Seasonal variation, Carbon dioxide, Calcium, Magnesium, Iron, Nitrates.

Observations on the Rihand Reservoir, based on monsoon inflow, reservoir level, evaporation loss, air and water temperature, rainfall and wind velocity are discussed in relation to the physical and chemical parameters of this body of water. Rihand Reservoir formed as the result of constructing a dam across River Rihand, is a tributary of the River Stone, which belongs to the Ganges System. A weak thermocline was observed, and the water showed a biogenic chemical stratification during the warmer months. Rihand is a monomictic tropical lake with a moderate nutrient supply, but is not very productive from the limnological point of view. The nutrient content of this lake declined from 1972 to 1974, but improved in 1975 and 1976 with the increase in rain and inflow of water. The productivity of the reservoir depends greatly on the nutrient level of the inflowing water from the catchment area, so that the monsoon inflow largely influences the water quality of the reservoir. The phytoplankton population is directly related to the inflow of water from the catchment area. (Peters-PTT)
W86-05165

FOOD SIZE SPECTRA AND SPECIES REPLACEMENT WITHIN HERBIVOROUS ZOOPLANKTON,
Oslo Univ. (Norway). Biologisk Inst.
D. O. Hessen, J. P. Nilssen, and T. O. Eriksen.
Internationale Revue der Gesamten Hydrobiologie, Vol. 71, No. 1, p 1-10, 1986. 1 tab, 5 fig, 42 ref.

Descriptors: *Zooplankton, *Algae, *Copepods, *Limnology, Lake Gjersjon, Norway, Seasonal variation, Predation, Bacteria, Daphnia, Phytoplankton, Rotifers, Nutrients.

The numerical relationship between Eudiaptomus gracilis and Bosmina longirostris was investigated in eight polyethylene enclosures in Lake Gjersjeen in S.E. Norway, during one month in early summer when both species are common. At the start of the experiment, the numerical relationship between Bosmina and Eudiaptomus was <1:10, but during the experimental period, a strong increase in Bosmina and a corresponding decrease in Eudiaptomus and medium-sized algae was observed. The shift from Eudiaptomus to Bosmina was probably due to strong competition on medium-sized algae while Bosmina in addition may utilize smaller algae and bacteria, not available to selective fish predation, suppressing Bosmina. (Peters-PTT)
W86-05168

FATTY ACIDS IN LIPIDS FROM PARTICULATE ORGANIC MATTER IN A EUTROPHIC LAKE, LAKE NAKANUMA, JAPAN,
Tsukuba Univ. (Japan). Inst. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W86-05171

ANALYSIS OF THE INSHORE MACROZOOBENTHIC COMMUNITY IN LAKE NAINI TAL, UP, INDIA,
Kumaun Univ., Naini Tal (India). Dept. of Zoology.
P. K. Gupta, and M. C. Pant.
International Revue der Gesamten Hydrobiologie, Vol. 71, No. 1, 115-125, 1986. 3 tab, 8 fig, 15 ref.

Descriptors: *Benthos, *Eutrophic lakes, *Pollution load, *Temperature effects, Lake Naini Tal, India, Sediments, Population density, Species diversity, Lakes, Seasonal variation, Life cycles.

Population density, species richness, diversity, dominance and similarity indices were examined in the inshore area (0 to 1 meter stratum) of Lake Naini Tal during 1978-1979. Significant changes in the zoobenthos community structures were found both in space and time. A classification based on similarity index values of the data from different sampling times showed two clusters of species: winter and summer. Similar analysis of the sample data from different sites suggested three clusters of species for polluted water, clean water and intermediate sites. The variation in the benthos community structure over the season is primarily related to temperature, availability of food and life cycle pattern, while its variation in space is related to sediment texture and degree of pollution. (Peters-PTT)
W86-05172

FIELD AND LABORATORY STUDIES ON NILE PHYTOPLANKTON IN EGYPT. I. SOME PHYSICAL AND CHEMICAL CHARACTERISTICS,
Assiut Univ. (Egypt). Dept. of Botany.
A. M. Ahmed, M. H. Haikal, A. A. Mohammed, and M. A. Zidan.
International Revue der Gesamten Hydrobiologie, Vol. 71, No. 1, p 127-138, 1986. 1 tab, 4 fig, 57 ref.

Descriptors: *Rivers, *Chemical composition, *Phytoplankton, *Physical properties, *Nile River, Egypt, Temperature effects, Dissolved oxygen, Nitrates, Phosphate Silicates, Chlorides, Photosynthesis, Seasonal variations, Monthly distributions, Hydrogen ion concentration, Sodium, Potassium, Calcium, Magnesium.

Monthly variations of some physical and chemical characteristics of Nile waters at Assiut (375 km south of Cairo, Egypt) during the period September 1980 to September 1982 were analyzed. The maximum temperature was recorded in summer and the minimum in winter. The highest concentrations of dissolved oxygen were always associated with increased phytoplankton populations, which result in greater photosynthetic activity and, accordingly, higher oxygen production. The pH values of Nile waters were in the vicinity of 8.0 The highest oxygen concentrations were recorded in the summer months. The total soluble salts and the total alkalinity exhibited almost identical trends. Nitrate, phosphate, silicate and chloride concentrations showed no major trends. (Peters-PTT)
W86-05173

COMPATIBILITY OF CARBON UPTAKE RATES CALCULATED FROM STABLE AND RADIOACTIVE ISOTOPE DATA: IMPLICATIONS FOR THE DESIGN OF EXPERIMENTAL PROTOCOLS IN AQUATIC PRIMARY PRODUCTIVITY,
Centre de Recherche en Ecologie Marine et Aquaculture, Nieul sur Mer (France).
Y. Collos, and G. Slawyk.
Journal of Plankton Research JPLRD9, Vol. 7, No. 5, p 595-603, September 1985. 1 tab, 3 fig, 26 ref.

Descriptors: *Phytoplankton, *Carbon radioisotopes, *Isotope studies, Primary productivity, Tracers, Mathematical studies.

Basic differences between the (13)C and the (14)C techniques of measuring carbon uptake by phytoplankton exist at the level of the isotopic analysis. With the first method, a ratio of isotopic abundances is measured on the sample, whereas an absolute amount of isotope is estimated with the second method. If a carbon source other than the labeled one is utilized by the phytoplankton during incubation, the stable isotope method may be biased. Specific uptake values will be underestimated by this effect. It is, however, possible to obtain unbiased estimates of the (13)C-labeled carbon uptake by using an equation containing a term describing the final particulate carbon concentration. Under this condition, carbon uptake rates derived from (13)C isotope data will always be compatible with the (14)C method of measuring primary production. These theoretical considerations have led to a redesign of experimental procedures for field work, as well as a modification of the analytical instrumentation used for both (13)C and (15)N tracer work. (Peters-PTT)
W86-05174

IN SITU PULSE LIGHT FLUOROMETER FOR CHLOROPHYLL DETERMINATION AS A MONITOR FOR VERTICAL AND HORIZONTAL PHYTOPLANKTON DISTRIBUTION IN LAKES,
Aarhus Univ. (Denmark). Botanical Inst.
U. Uehlinger.
Journal of Plankton Research JPLRD9, Vol. 7, No. 5, p 605-615, September 1985. 10 fig, 21 ref.

Descriptors: *Monitoring, *Chlorophyll A, *Mesotrophic lakes, *Algae, *Vertical distribution, *Fluorometry, *Phytoplankton, Lake Lucerne, Lakes, Epilimnion.

Methodological problems with in vivo fluorescence (IVF) measurement using an in situ pulse light fluorometer were investigated in order to validate this method for monitoring the vertical and horizontal chlorophyll A distribution in lakes. Field data were collected at two stations in the mesotrophic Lake Lucerne (Kreuztrichter, Kastanienbaum), and some measurements were performed in limnocorrals suspended in the same lake. The correlation between chlorophyll A and IVF was poor in the upper epilimnion of a mesotrophic lake. The IVF of algal cultures and natural phytoplankton is very sensitive to changes in the light environment. The response of the IVF to rapid light fluctuations depends on the amplitude of the light intensity and the light conditions to which the algae were exposed before the onset of light fluctuations. The variability of the ratio IVF:chlorophyll A concentration makes a permanent calibration of the IVF against chlorophyll A necessary. (Peters-PTT)
W86-05175

14C-LABELLING PATTERNS OF PHYTOPLANKTON: SPECIFIC ACTIVITY OF DIFFERENT PRODUCT POOLS,
Michigan State Univ., East Lansing. Pesticide Research Center.
For primary bibliographic entry see Field 5A.
W86-05176

PHYTOPLANKTON PRODUCTIVITY IN TURBID WATERS,
Orange Free State Univ., Bloemfontein (South Africa). Inst. of Environmental Sciences.
For primary bibliographic entry see Field 5C.
W86-05177

COMPARISON OF CARBON-SPECIFIC GROWTH RATES AND RATES OF CELLULAR INCREASE OF PHYTOPLANKTON IN LARGE LIMNETIC ENCLOSURES,
Freshwater Biological Association, Windermere (England).
C. S. Reynolds, G. P. Harris, and D. N. Gouldney.
Journal of Plankton Research JPLRD9, Vol. 7,

No. 6, p 791-820, November 1985. 19 fig, 1 tab, 58 ref. Natural Environment Research Council Contract No. DGR/410/380.

Descriptors: *Phytoplankton, *Photosynthesis, *Growth rates, Lund tubes, Chlorophyll growth rates, Respiration, Excretion, Carbon radioisotopes, Lake morphology, Carbon cycle, Mathematical analysis.

Potential carbon-specific growth rates of phytoplankton were estimated from a series of measurements of photosynthetic radio-carbon uptake over 4- and 24-hour exposure periods in the light fields of three large limnetic enclosures (Lund Tubes), each providing different limnological and trophic conditions. Photosynthetic behavior and short-term, chlorophyll-specific carbon-fixation rates conformed to well established criteria but, over 24 hr, the net retention represented 23-82% of the carbon fixed during the daylight hours. Potential mean growth rates of the photo-autotrophic community were calculated as the net exponential rates of daily carbon-accumulation relative to derived, instantaneous estimates of the cell carbon content. Apparent actual community growth rates were calculated as the sum of the exponential rates of change of each of the major species present, corrected for probable rates of in situ grazing and sinking, and expressed relative to the fraction of total biomass for which they accounted. The corresponding values were only occasionally similar. It is suggested that the measured carbon fixation rates represent a capacity for cellular increase which, owing to other likely limitations upon growth, is seldom realized. Apparent rates of loss of whole cells do not account for the loss of carbon. The unaccounted loss is best explained by physiological voiding of excess carbon (by respiration, photorespiration, excretion, for example) prior to the formation of new cells. (Peters-PTT)
W86-05178

SEASONAL DYNAMICS OF SKISTODIAPTOMUS PALLIDUS HERRICK AND OTHER ZOOPLANKTON POPULATIONS IN DEER LAKE, S. W. BRITISH COLUMBIA,

Waikato Univ., Hamilton (New Zealand). School of Science.
M. A. Chapman, J. D. L Green, and T. G. Northcote.
Journal of Plankton Research JPLRD9, Vol. 7, No. 6, p 867-876, November 1985. 6 fig, 28 ref.

Descriptors: *Daphnia, *Deer Lake, *Population dynamics, *British Columbia, Turbidity, Burnaby, Eutrophic lakes, Algae, Seasonal variation.

Seasonal environmental conditions and dynamics of a Skistodiaptomus pallidus population are given for a 2-year period in eutrophic Deer Lake, Burnaby, British Columbia. The lake is small and relatively shallow, surrounded by parkland and agricultural fields. Much of its watershed is under urban and industrial use. The lake is heavily used for recreation, but with increasing concern, because of high water turbidity resulting at times from algae. One major inlet and a number of small inlets carry water which is often nutrient-rich into the lake, creating a eutrophic environment. Characteristics of S. pallidus in the lake appear similar to those in more southerly habitats. Breeding occurs between March and November with about five generations produced per year. The annual cycles of Daphnia rosea, D. pulicaria, Diacyclops bicuspidatus thomasi, Bosmina longirostris, rotifers and Chaoborus flavicans are described. (Peters-PTT)
W86-05180

PRACTICAL GUIDELINES FOR THE USE OF ZOOPLANKTON LENGTH-WEIGHT REGRESSION EQUATIONS,

McGill Univ., Montreal (Quebec). Dept. of Biology.
D. F. Bird, and Y. T. -Prairie.
Journal of Plankton Research JPLRD9, Vol. 7, No. 6, p 955-960, November 1985. 1 fig, 9 ref, append.

Descriptors: *Zooplankton, *Statistical methods, *Regression analysis, Biomass, Ecosystems, Daphnia, Mathematical equations, Water analysis.

Guidelines are presented for the use of length-weight equations, relating to four potential pitfalls in the measurement of planktonic biomass, an important component for the analysis of aquatic systems. The first pitfall to be avoided is the grouping of length measurements prior to the estimation of a common weight. To avoid miscalculation, log weights should be estimated individually from each long-transformed length, retransformed to original units. The mean weight per organism can then be taken. The second issue to be considered is bias due to transformation. The magnitude of the bias is a function of the scatter about the regression line, but does not depend in any practical way on variables other than the residual mean square. The third issue is the question of precision of length measurements. Excessive error in length measurement can affect equation coefficients. Unreasonably large measurement errors are needed to effect a change in the most sensitive predictions. Little benefit can be derived from overly fastidious length measurements. Maximum practical measurement intervals are recommended at 0.05 mm for daphnids and Diaphanosoma, 0.03 mm for the smaller Ceriodaphnia and Bosmina, and 0.015 mm for the special case of Holopedium gibberum where only abdomen length is measured. The final issue involves confidence limits around the overall predicted mean weight. Confidence limits should be provided whenever possible to help the reader decide on the reliability of the data, and to allow quantitative tests of hypotheses involving measures of standing crop. The fact that the data are log-transformed complicates matters because confidence limits are ot symmetrical around an individual predicted weight, and because confidence limits are larger around larger organisms. A simple nonparametric technique called the bootstrap can be used to provide reliable confidence limits around the estimate. (Peters-PTT)
W86-05182

ASPECTS OF THE FEEDING ECOLOGY OF TURBIN WATER ZOOPLANKTON. IN SITU STUDIES OF COMMUNITY FILTRATION RATES IN SILT-LADEN LAKE LE ROUX, ORANGE RIVER, SOUTH AFRICA,

Rhodes Univ., Grahamstown (South Africa). Inst. of Freshwater Studies.
R. C. Hart.
Journal of Plankton Research JPLRD9, Vol. 8, No. 3, p 401-426, May 1986. 8 fig, 3 tab, 78 ref.

Descriptors: *Limnology, *Ecology, *Turbidity, *Silt, *Lake le Roux, *Orange River, *South Africa, *Zooplankton, Filtration, Oligotrophic Lakes, Reservoirs, Lake Verwoerd, Copepods, Daphnia, Biomass, Temperature effects, Algae, Regression analysis, Statistical analysis.

Diel vertical studies of zooplankton community filtration rates (CFR) were undertaken in situ over two annual cycles in a sheltered bay of Lake le Roux, a large silt-laden oligotrophic reservoir in the arid subtropics of South Africa. Lake le Roux was formed in September 1976 by the impoundment of the Orange River by the P. K. le Roux Dam. Water transparency varies considerably and depends largely upon the hydrological manipulation of this reservoir and its larger upstream sister, Lake Verwoerd. The grazer community is dominated by a copepod, Metadiaptomus meridianus, while Daphnia gibba, D. barbata and Moina brachiata account for the balance. Spot estimates of CFR varied from 0.1 to 75%/day in the upper 10 meters, while depth-integrated values ranged seasonally from 0.1 to 15%/day. Most variations in CFR were attributable to seasonal changes in grazer biomass and temperature. There variables are used to construct multiple linear regression models for the prediction of CFR in this system. Some higher CFR values were measured in warmer waters with an unusually rich zooplankton. No significant diel vertical changes in CFR or grazer biomass were observed. Both variables declined sharply with depth. Inorganic turbidity dominated the seston, with algal carbon accounting for less than about 20% of the total POC (particulate organic carbon) available. Feeding responses of this turbid-water community were generally consistent with observations made of other assemblages, apart from the seemingly high specific filtration rates which, atypically, were inversely related to temperature. (Peters-PTT)
W86-05183

SOME CHARACTERISTICS OF THE CARBON COMPOUNDS RELEASED BY DAPHNIA,

Norges Tekniske Hoegskole, Trondheim. Inst. of Marine Biochemistry.
Y. Olsen, K. M. Varum, and A. Jensen.
Journal of Plankton Research JPLRD9, Vol. 8, No. 3, p 505-517, May 1986. 4 fig, 7 tab, 18 ref.

Descriptors: *Daphnia, *Carbon compounds, *Algae, Organic carbon, Particle size, Chlorophyll A, Water pollution sources, Plankton.

A rough characterization of the organic carbon released by some species of Daphnia grazing on algae is presented. The daphnia species studied released 18 to 100% of the algal carbon ingested as dissolved and particulate carbon compounds, presumably as feces. The particulate fraction constituted on average 79% of the total released compounds, leaving 21% as dissolved compounds. The particles released were very small, transparent, and not visible by light microscopy. They contained significant amounts of chlorophyll derivatives. The dissolved compounds consisted mainly of small molecules which are utilized by planktonic bacteria. Particulate organic carbon and chlorophyll A should not be used as measures for algal carbon in grazing experiments with daphnia. Both parameters are influenced by the animals' fecal particles, yielding lowered clearance rates when compared with those obtained by using cell numbers as a measure for algal carbon. (Peters-PTT)
W86-05185

REGULATION OF BACTERIAL SECONDARY PRODUCTION IN TWO EUTROPHIC LAKES AND IN EXPERIMENTAL ENCLOSURES,

Copenhagen Univ., Hilleroed (Denmark). Det Ferskvands-Biologiske Lab.
For primary bibliographic entry see Field 5C.
W86-05186

DETRITUS IN THE LITTORAL OF SEVERAL MASURIAN LAKES (SOURCES AND FATES),

Warsaw Univ. (Poland). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5B.
W86-05189

OCCURRENCE OF GASTROPODA IN THE LAKE LITTORAL AND THEIR ROLE IN THE PRODUCTION AND TRANSFORMATION OF DETRITUS I. SNAILS IN THE LITTORAL OF MIKOLAJSKIE LAKE -- GENERAL CHARACTERISTICS OF OCCURRENCE,

Warsaw Univ. (Poland). Dept. of Hydrobiology.
A. Kolodziejczyk.
Ekologia Polska, Vol. 32, No. 3., p 441-468, 1984. 9 fig, 3 tab, 80 ref.

Descriptors: *Snails, *Limnology, *Littoral environment, *Mikolajskie Lake, Detritus, Periphyton, Seasonal variation, Aquatic plants, Biomass, Lake morphology, Poland.

Various aspects of the occurrence of snails in the littoral of the Mikolajskie Lake were studied. The variation in numbers, biomass, and dominance structure of the snails living on the most numerous littoral substratex were studied. In many cases snails were a clearly dominant group among the invertebrate macrofauna, especially with regard to biomass. This dominance is particularly conspicuous on plants. Snails utilize lake macrophytes in different ways. Emergent plants are inhabited throughout the year. On plants with annual aboveground shoots, a marked growth in numbers could be seen, and in biomass as well, in the successive months. On plants with perennial aboveground shoots, used by animals as a substrate throughout the year, changes in numbers of the snails in successive months are irregular. For both these plant

groups, great differences have been found also in the species composition and dominance structure of the snails inhabiting them. In summer, the largest numbers of snails per 1 sq m of the littoral are found on submerged vegetation and on plants with floating leaves, as well as on the stony bottom. In sediments, and on the annual P. australis, both the average numbers of snails and their biomass are many times greater than in the habitats mentioned earlier. It has been estimated that in the ice-free period, submerged plants, and those with floating leaves hold up to 63% of numbers, and up to 79% of biomass of all the snails in the Mikolajskie Lake. On account of its very small surface area, the stony bottom of this lake, as a substrate, plays a very small role. In spite of its considerable colonizable surface area, P. australis harbors a small number and low biomass of snails. In spring, the main environment where most snails in the Mikolajskie Lake live is the sediment zone. (see also W86-05191)(Lantz-PTT)
W86-05190

OCCURRENCE OF GASTROPODA IN THE LAKE LITTORAL AND THEIR ROLE IN THE PRODUCTION AND TRANSFORMATION OF DETRITUS II. ECOLOGICAL ACTIVITY OF SNAILS,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
A. Kolodziejczyk.
Ekologia Polska, Vol. 32, No. 3., p 469-492, 1984. 12 tab, 76 ref.

Descriptors: *Snails, *Limnology, *Littoral environment, *Feces, Gastropods, Detritus, Mikolajskie Lake, Periphyton, Seasonal variation, Aquatic plants, Lake morphology, Poland.

Various signs were studied of the activity of snails connected with the production and transformation of detritus by these animals. Most of the snail taxa under study have been found to prefer plant detritus and periphyton as their food, with L. stagnalis the only species that readily ate living plants with delicate tissues. A comparison of the quantities consumed during 24 hours of preferred and avoided foot items, demonstrate that the former were eaten in much larger amounts. The organic matter contained in them also was better assimilated, with about 30-80% of the organic matter ingested being returned to the environment in the form of fecal detritus. Calculated per individual, the circadian production of feces by the particular species is very different, ranging on an average from 0.5 mg dry wt. in Theodoxus fluviatilis to 40.8 mg in Planorbarius corneus. If calculated per 1 g dry wt of animal, the respective values appear to be closer, amounting on an average to about 30-65 mg for most of the taxa analyzed. For snails of the same species the amount of feces excreted clearly depends on the kind of food, but little on the body-size of an animal, over a fairly wide range of this parameter. In T. fluviatilis a lack of correlation has been found, over a fairly wide range of temperature values, between it, and the number of fecal pellets excreted. In all experiments a great variation in the amount of feces excreted was observed among individuals of the same species, as well as in the same individuals between successive days. It was found that snail also excreted small amounts of feces underneath the ice cover in winter. Based on this study, the quantity of feces produced by different snail taxa has been estimated. Snails inhabiting submerged macrophytes excrete as much as 90% of the total amount of 88 tons of dry weight of snail fecal detritus input to Mikolajskie Lake in summer. Snails living on emergent macrophytes produce as little as 2% of the total snail feces. Very small amounts of feces are excreted by stony-bottom-dwelling snails. This results from the fact that this environment represents a small part of the surface area of the lake, and that the dominant species in this lake is T. fluviatilis which excretes the smallest amount of feces among the snail taxa studied. (see also W86-05190)(Lantz-PTT)
W86-05191

LIFE CYCLE AND THE ZONES OF OCCURRENCE OF MESOCYCLOPS LEUCKARTI CLAUS (CYCLOPOIDA, COPEPODA),
Warsaw Univ. (Poland). Dept. of Hydrobiology.
K. Papinska.
Ekologia Polska, Vol. 32, No. 3., p 493-531, 1984. 21 fig, 4 tab, 53 ref.

Descriptors: *Copepods, *Sediments, *Limnology, *Water depth, Masurian lakes, Eutrophication, Mikolajskie Lake, Daphnia, Nutrient availability, Seasonal variation, Lake morphology, Poland.

Research studies were conducted which covered 37 lakes in the Masurian lakeland region of Poland, the most intensive of which were conducted in Mikolajskie Lake. Seasonal variations in numbers, zone of occurrence, and age structure of the Mesocyclops leuckarti population were analyzed for 3 consecutive years against thermal conditions, oxygen content, and composition and total abundance of the whole crustacean community. The life cycle of M. leuckarti can follow one of three patterns: with a diapause lasting about 9 months, without a diapause, and with a diapause lasting about 5 months. A comparison was also made of the course of the life cycles of M. leuckarti and M. (Th.) oithonoides, a closely related species with similar requirements. It was found that M. leukarti is present in the near-bottom water layer and in the bottom sediments, as well as the pelagic zones. This distribution varied however, dependent upon the location of available nutrients, which in turn varied depending upon seasonal distributions of oxygen, and the bottom sediment chemistry. In the bottom sediments, both resting stages and active individuals of M. leukarti were found. An analysis of the data from 35 lakes, collected during the summer stagnation, has demonstrated that the presence of M. leukarti in the bottom sediments in summer depends also on the composition and numbers of the cyclopoid copepods found in the pelagial zone, and that not in all lakes does the life cycle of M. leuckarti include a diapause lasting about 9 months. It seems that both the occurrence above the bottom, and the passing of M. leuckarti into the bottom sediments to diapause, there are to a large extent, controlled by the conditions of the biotic environment, which make it possible for the species to outlast adverse food conditions. (Lantz-PTT)
W86-05192

ZONATION IN PERIPHYTON COLONIZING CONCRETE BLOCKS ON THE SHORE OF LAKE ZEGRZYNSKIE,
Warsaw Univ. (Poland). Dept. of Hydrobiology.
E. Pieczynska, and D. Banas.
Ekologia Polska, Vol. 32, No. 3., p 533-552, 1984. 11 fig, 33 ref.

Descriptors: *Algae, *Concretes, *Artificial lakes, *Lake Zegrzynskie, *Periphyton, Nematodes, Algal growth, Water level fluctuations, Cyanophyta, Chlorophyta.

The qualitative and quantitative composition of periphyton colonizing the concrete embankments of Lake Zegrzynskie were analyzed. The effect of water level fluctuations on the number and composition of periphytic animals was investigated, including the colonization rate of periphyton-free substrates. On the emergent parts of the concrete blocks, the crustaceous type of periphyton is formed, mainly by blue-green algae. On the submerged parts, filamentous periphyton grow, with green algae being the dominant species. Along the shoreline, there is a narrow belt of periphyton which varies in composition. The number of animal species present, and the density of individuals, are greater with filamentous periphyton (Nematoda spp. dominated). The decreasing water level caused drying, resulting in a distinct reduction of periphytic organisms. Field experiments on colonization of bare substrates show that the new periphyton structure in concrete blocks is dependent on water level fluctuations. (Lantz-PTT)
W86-05193

THERMAL AND OXYGEN CONDITIONS AND THE CHEMICAL COMPOSITION OF THE WATER IN THE GREAT MASURIAN LAKES,
Instytut Rybactwa Srodladowego, Olsztyn-Kortowo (Poland).
For primary bibliographic entry see Field 5C.
W86-05194

SOME OBSERVATIONS ON HOCHSTETTER'S FROG IN THE CATCHMENT OF THE MOTU RIVER, EAST CAPE,
Department of Scientific and Industrial Research, Havelock North (New Zealand). Ecology Div.
J. A. McLennan.
New Zealand Journal of Ecology, Vol. 8, p1-4, 1985. 3 fig, 1 tab, 6 ref.

Descriptors: *Frogs, *Rivers, *Catchment areas, Motu River, New Zealand, Silting, Ecological effects, Environmental effects, Stream degradation.

The distribution and abundance of Hochstetter's frog (Leiopelma hochstetteri Fitzinger) in part of the catchment of the Motu River was assessed during two short surveys in 1981 and 1983. The Motu River rises in the Ruakumara Range and flows northwest through steep, heavily forested hill country before entering the Bay of Plenty and Haupoto, East Cape, New Zealand. Specimens were found in most tributaries examined and on banks of the main river, above extreme flood level. The highest counts were obtained in areas with stable, moss covered substrates, shaded by overhanging vegetation. Frogs in the Upper Motu River were significantly further away from the edge of streams than those in the catchment of the Takaputahi River. Geologically, the catchment of the Motu River is inherently unstable and some silting and degradation of stream occurs naturally. Since the Hochstsetter's frog is vulnerable to any disturbance that affects the stability of streams, the added burden of high numbers of browsing animals may increase erosion in the catchment to levels which adversely affect the frog population. (Peters-PTT)
W86-05197

UNUSUAL MICROORGANISMS OBSERVED IN NEW ZEALAND HOT SPRINGS,
Waikato Univ., Hamilton (New Zealand). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W86-05200

METHOD FOR ENUMERATING PROTOZOA IN A VARIETY OF FRESHWATER HABITATS,
Southampton Univ. (England). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W86-05201

RELATIONSHIP BETWEEN MICROBIAL ACTIVITY OF STREAM SEDIMENTS, DETERMINED BY THREE DIFFERENT METHODS, AND ABIOTIC VARIABLES,
Freshwater Biological Association, Wareham (England). River Lab.
For primary bibliographic entry see Field 5A.
W86-05202

ENTERIC LUMINOUS MICROFLORA OF THE POND-CULTURED MILK FISH CHANOS CHANOS (FORSKAL),
Annamalai Univ., Annamalainagar (India). Centre of Advanced Study in Marine Biology.
A. Ramesh, R. Nandakumar, and V. K. Venugopalan.
Microbial Ecology MCBEBU, Vol. 12, No. 2, p 231-236, June 1986. 3 fig, 1 tab, 8 ref.

Descriptors: *Enteric bacteria, *Fish farming, *Ponds, Milkfish, Sediment, Salinity, Biomass, Vibrio harveyi, Vibrio fischeri, Brackish water, Luminous bacteria.

The types, densities, and distribution of the bacteria found in the gut of farmed milkfish was investigated. The fish were collected from a brackish water culture pond adjacent to the Vellar estuary from which water was pumped to the pond. Significant differences in luminous bacterial numbers were found between gut and pond water and between gut and pond sediment, but not between pond water and sediment. No significant variation in luminous bacterial population among the gut

regions was observed. The quantity of ingesta in the fish gut does not appear to influence the biomass of luminous bacteria. Apart from salinity, environmental parameters did not appear to control luminous bacterial populations of the gut. V. harveyi and V. Fischeri were the two most commonly encountered species, and of the two luminous species, V. harveyi was predominant. (Peters-PTT)
W86-05204

SOURCES AND SINKS OF IONS IN A SOFT WATER, ACIDIC LAKE IN FLORIDA,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
For primary bibliographic entry see Field 5B.
W86-05217

EFFECT OF SERIAL CORRELATION ON RESERVOIR SIZE,
Monash Univ., Clayton (Australia).
R. M. Phatarfod.
Water Resources Research WRERAO, Vol. 22, No. 6, p 927-934, June 1986. 5 tab, 21 ref.

Descriptors: *Correlation analysis, *Reservoir capacity, Correlation coefficient, Mathematical analysis, Model studies, Inflows, Seasonal variation, Flow profiles.

The effect of the serial correlation coefficient of the inflows, on reservoir size, when large reservoirs are involved, is investigated. Specifically, reservoir size ratios, i.e., the ratio of the reservoir size when the serial correlations are present to the size when they are neglected, assuming reliability and draft to be the same, are calculated. When the reservoir is operated on an annual basis, it is shown that for low drafts the ratio is dependent on the inflow model, whereas for the limiting case when the draft ratio approaches the value 1, the ratio is approximately $(1 + p)/(1 - p)$, irrespective of the inflow model, where p is the annual serial coefficient. For the case when the reservoir is operated on a seasonal basis, the ratio considered is that of the reservoir size when all the serial correlations are present to the size when the year-end seasonal correlation is neglected. It is shown that for large reservoirs this ratio is mainly dependent on the annual flow parameters irrespective of the within-year pattern of inflows. (Lantz-PTT)
W86-05253

KINETICS OF MICROBIAL MANGANESE OXIDATION AND TRACE METAL BINDING IN SEDIMENTS: RESULTS FROM AN IN SITU DIALYSIS TECHNIQUE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
P. E. Kepkay.
Limnology and Oceanography, Vol. 30, No. 4, p 713-726, July 1985. 10 fig, 2 tab, 33 ref.

Descriptors: *Kinetics, *Microbial Manganese Oxidation, Trace Metals, Sediments, Ferromanganese, Nickel, Cobalt, Copper, Lake Charlotte, Nova Scotia.

Sediments associated with freshwater ferromanganese concretions in Lake Charlotte, Nova Scotia, contained microscopic precipitates of manganese and iron were dispersed throughout the sediment. They were as rich in nickel, cobalt, and copper as deep sea concretions. In addition, the development of the precipitates appeared to be associated with the microbial oxidation of manganese. Results from the deployment of poisoned and unpoisoned dialysis probes or 'peepers' demonstrated that microbial manganese oxidation and nickel binding were closely associated, causing a fivefold enhancement of abiotic processes such as adsorption. The microbial enhancement of copper binding was far less pronounced, due to organic-metal interactions in competition with manganese oxidation. Organic-metal interactions and oxidation may both have been in effect during iron binding, but the relative importance of the two processes could not be determined from the kinetic data. (Lantz-PTT)
W86-05278

WIND-FORCED MOTIONS IN STRATIFIED LAKES AND THEIR EFFECT ON MIXED-LAYER SHEAR,
Western Australia Univ., Nedlands. Centre for Water Research.
S. G. Monismith.
Limnology and Oceanography, Vol. 30, No. 4, p 771-783, July 1985. 8 fig, 1 tab, 17 ref.

Descriptors: *Wind-forced motions, *Stratified lakes, *Mixed layers, *Shear, Model studies.

The solution for the response of a rectangular, n-layered, stratified lake to an arbitrarily varying (in time) wind stress is presented. The case $n = 3$ is considered in detail. For a three-layered lake the response is made up of the individual responses of one external and two internal modes. When the upper layer is shallow relative to the other two layers, the mixed-layer shear is due almost entirely to the slower, second-mode response. Moreover, the upper interface can tilt quite severely while the lower interface remains nearly flat. Calculations based on the three-layer model are compared with measurements made in Wellington Reservoir, Western Australia. (Author's abstract)
W86-05279

PHOSPHORUS DEPOSITION FROM THE EPILIMNION OF ONONDAGA LAKE,
Upstate Freshwater Inst., Inc., Syracuse, NY.
M. C. Wodka, S. W. Effler, and C. T. Driscoll.
Limnology and Oceanography,Vol. 30, No. 4, p 833-843, July, 1985. 3 fig, 3 tab, 51 ref.

Descriptors: *Phosphorus, *Deposition, *Epilimnion, *Limnology, *Onondaga Lake, Fluctuations, Sediment traps, Cycling nutrients, Organic carbon, Inorganic compounds, Sedimentation, Vertical flow.

The downward flux of inorganic and organic fractions of phosphorus from the epilimnion of calcium-rich, hypereutrophic, Onondaga Lake was determined over 7 months in the water and in sediment traps. Material was collected in sediment traps for short and long periods (average of 4 and 14 days) throughout the study. A linear relationship between overlying concentrations of particulate phosphorus and downward flux (mg P/sq m/day) of phosphorus was only weakly supported (significant at 99.5% confidence level, r to the (2) power = 0.156). About 30% of the phosphorus was in inorganic form. The time average flux of particulate phosphorus (45.4 mg P/sq m/day) was greater than any values in the literature for other systems. The substantial contribution of inorganic phosphorus to total phosphorus deposition and the large magnitude of the overall downward flux may be attributed to oversaturation with respect to the solubility of calcite in the epilimnion of the lake. This then facilitates the sedimentation of phosphorus with calcite and may also enhance the settling of phytoplankton cells. A comparison of the sediment trap data with annual mass balance calculations suggest that phosphorus settling across the metalimnion cycles vertically, on the average about three times, before it is exported from the lake or incorporated into the sediments. (Lantz-PTT)
W86-05280

TEMPORAL AND SPATIAL TRENDS IN METAL LOADINGS TO SEDIMENTS OF THE TURKEY LAKES, ONTARIO,
Department of Fisheries and Oceans, Owen Sound (Ontario). Great Lakes Fisheries Research Branch.
For primary bibliographic entry see Field 5B.
W86-05346

ENVIRONMENTAL PH INFLUENCES GROWTH AND TISSUE CHEMISTRY OF THE SUBMERSED MACROPHYTE VALLISNERIA AMERICANA,
State Univ. of New York at Binghamton. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W86-05347

OVERVIEW OF THE HYDROLOGIC CONCERNS RELATED TO WETLANDS IN THE UNITED STATES,
Connecticut Univ., Storrs. Ecology Section.
V. Carter.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 2, p 364-374, February 1986. 1 fig, 123 ref.

Descriptors: *Wetlands, *Hydrologic aspects, Vegetation, Ecosystems, Surface-groundwater relationships, Hydrologic budget, Floods, Recharge, Base flow, Estuarine environment, Water quality.

Regional, geologic, topographic, and climatic differences create a tremendous diversity in wetland types and wetland vegetation in the United States. Wetland hydrology, a primary driving force influencing wetland ecology, development, and persistence, is as yet poorly understood. The interaction between groundwater and surface water and the discharge-recharge relationships in wetlands affect water quality and nutrient budgets as well as vegetative composition. Hydrologic considerations necessary for an improved understanding of wetland ecology include detailed water budgets, water chemistry, water regime, and boundary conditions. Wetland values are often based on perceived wetland functions. These hydrologic functions include (1) flood storage and flood-peak desynchronization, (2) recharge and discharge, (3) base flow and estuarine water balance, and (4) water-quality regulation. Expanded research and basic data collection focussed on wetland hydrology and its relation to wetland ecology are needed to identify and quantify the hydrologic functions of wetlands. (Lantz-PTT)
W86-05349

HYDROLOGY, DEVELOPMENT, AND BIOGEOCHEMISTRY OF OMBROGENOUS PEAT BOGS WITH SPECIAL REFERENCE TO NUTRIENT RELOCATION IN A WESTERN NEWFOUNDLAND BOG,
Connecticut Univ., Storrs. Ecology Section.
A. W. H. Damman.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 2, p 384-394, February 1986. 12 fig, 1 tab, 63 ref. NSF Grant Nos. GS-8744 and DEB-7905195.

Descriptors: *Peat bogs, *Hydrologic aspects, *Geochemistry, *Nutrients, *Newfoundland, Water supply, Sodium, Potassium, Magnesium, Calcium, Seasonal variation, Vegetation, Precipitation, Ombrogenous bogs.

Ombrogenous bogs differ fundamentally from other peatlands in their hydrology, and this affects peat accumulation and bog development as well as the elemental concentrations in peat and water. In oceanic and northern parts of the raised bog zone, the surface of the bog center remains below the critical profile of the water mound because factors other than moisture supply limit its maximum height. In the surface peat, Na and K decrease with depth, whereas other elements increase to a greater or smaller extent. Most elements occur in surprisingly low concentrations below the anaerobic level. In an ombrotrophic bog in western Newfoundland, Na, Mg, and Ca concentrations of bog water were 5,4-5, and 0.5 times higher, respectively, than in precipitation. K and Mg increased downslope, especially in spring, but not during the vegetation season. In July and August, 20-30% of the Mg, 75-80% of the K, and 93% of the Ca are removed from the precipitation while the water seeps over the bog. Uptake by vegetation is primarily responsible, but Ca is mostly adsorbed on the peat. Increased water flow, rather than higher nutrient concentration, appears to account for the occurrence of more nutrient-demanding species. (Lantz-PTT)
W86-05350

PRAIRIE MARSHES IN WESTERN CANADA, WITH SPECIFIC REFERENCE TO THE ECOLOGY OF FIVE EMERGENT MACROPHYTES,
Manitoba Univ., Winnipeg. Dept. of Botany.
J. M. Shay, and C. T. Shay.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 2, p 443-454, February 1986. 3 fig, 3 tab, 75 ref.

Descriptors: *Marshes, *Marsh plants, *Canada, *Macrophytes, Ecology, Manitoba, Saskatchewan, Alberta, Water level, Chemical analysis, Salinity, Plant growth, Saline water, Precipitation, Standing crops, Wetlands.

Prairie marshes in western Canada occur in the Manitoba, Saskatchewan, and Alberta plains. They are dynamic habitats characterized by fluctuations in water levels and water chemistry. Marsh habitats form an east-west gradient that involves a decrease in precipitation (525-350 mm/yr) and an increase in its variability. Within the region, water salinity ranges from fresh to hypersaline. Water levels and chemistry coupled with life history features influence the distribution and successional role of emergent macrophytes. Five dominant emergents have aboveground standing crops of between 425 (Scirpus lacustris ssp. glaucus) and 1750 g/sq m (Typha latifolia). They vary in reproductive strategy and tolerance to water levels and salinity. S. Lacustris ssp. glaucus grows in deep water with conductivities < 15 mS/cm, and spreads vegetatively. T. latifolia, tolerant of water fluctuations and salinity < 10 mS/cm, spreads both vegetatively and by seed, particularly under drawdown. Phragmites australis tolerates a wide range of moisture conditions and salinities (< 20 mS/cm). It propagates primarily by rhizomes and runners. S. lacustris ssp. validus thrives under unstable water regimes but is saline intolerant (<2 mS/cm). It is short lived (+ 3 years) and reproduces primarily by seed. S. martimus var. paludosus, which dominates western wetlands, tolerates hypersaline conditions (+ 45 mS/cm), prefers changing water levels, and spreads both vegetatively and by seed. (Lantz-PTT)
W86-05351

PHOTOCHEMICAL AND MICROBIAL DEGRADATION OF 2,4,5-TRICHLOROANILINE IN A FRESHWATER LAKE,
Georgia Univ., Athens. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W86-05392

ECOLOGICALLY DERIVED GUIDELINES FOR MANAGING TWO NEW ZEALAND LAKES,
Otago Univ., Dunedin (New Zealand). Dept. of Botany.
For primary bibliographic entry see Field 6E.
W86-05399

QUANTITATIVE TECHNIQUE FOR ESTIMATING THE BOUNDARIES OF WETLANDS FROM VEGETATION DATA,
Landplan Collaborative Ltd., Guelph (Ontario).
For primary bibliographic entry see Field 2I.
W86-05411

2I. Water In Plants

GERMINATION OF TEN SHORELINE PLANTS IN RELATION TO SEED SIZE, SOIL PARTICLE SIZE AND WATER LEVEL: AN EXPERIMENTAL STUDY,
Ottawa Univ. (Ontario). Dept. of Biology.
P. A. Keddy, and P. Constabel.
Journal of Ecology, Vol. 74, No. 1, p 133-141, March 1986. 6 fig, 30 ref.

Descriptors: Descriptors *Water level, *Shoreline, *Plants, Ontario, Canada, Seed size, Soil particle size, Wetland plants.

The zonation of plants along environmental gradients is particularly pronounced on lakeshores where species are distributed along the two gradients of water depth and exposure to waves. Soil particle sizes vary and may influence germination and early establishment. The effect of position along a particle-sized gradient on germination of different sized seeds was studied. Seeds of ten wetland plants (Acorus calamus, Alisma plantago-aquatica, Bidens cernua, B. vulgata, Cyperus aristatus, Lythrum salicaria, Polygonum punctatum, Sagittaria latifolia, Scirpus americanus, and Typha angustifolia) were vernalized and then sown along a particle size gradient with seven stages ranging from 0.125 to 0.250 to 8 to 16 mm. The seeds were collected from several wetlands in Lanark County and the adjacent Regional Municipality of Ottawa-Carleton, Ontario, Canada. Two water levels, 1 cm and 4 cm below the soil surface, were provided. The proportion of seeds producing established seedlings was determined for each particle size and each species. In the drier treatment nine out of ten species germinated differentially along the gradient. In the wetter treatment, only three out of ten species so responded. In both wet and dry treatments, those species which did respond significantly to the gradient had a shared preference for the fine soil. The single exception was Acorus calamus in the dry treatment. The species with the smallest seeds generally showed the greatest response to the gradient. Large seeded species had the broadest tolerances for variation in soil particle sizes. On lakeshores, the fine particles associated with sheltered bays would allow the highest recruitment. These effects would be most pronounced during periods of low water. The zonation of adult plants is apparently not produced by species with different sized seeds requiring different soil particle sizes for maximum germination. (Peters-PTT)
W86-04694

EFFECT OF WATER STRESS UPON POLYAMINE LEVELS IN BARLEY (HORDEUM VULGARE L.) LEAVES,
Birkbeck Coll., London (England). Dept. of Botany.
L. B. Turner, and G. R. Stewart.
Journal of Experimental Botany, Vol. 37, No. 175, p 170-177, February 1986. 3 fig, 1 tab, 21 ref.

Descriptors: *Water stress, *Barley, *Leaves, Water potentials, Polyamines, Plant Physiology, Drought, Turgidity.

Changes are described in the levels of putrescine, spermidine and spermine in intact plants during the gradual development of water stress, using varieties of barley which differ in their tolerance to drought primarily as a consequence of their inherent water requirements. After 6 days without water Alger/Ceres, Palmella Blue and Rihane had accumulated putrescine, although only in concentrations up to twice those found in the controls, but Roho had a decreased putrescine content. One common response was identified; the accumulation and subsequent loss of putrescine was dependent upon the maintenance and loss of leaf turgor respectively. Varietal differences in putrescine accumulation were related to water consumption rates and the extent of osmotic adjustment. Spermine behaved in a similar manner to putrescine but spermidine levels always decreased. Proline levels were 150 fold higher and glycine-betaine levels 50-fold higher than polyamines in stressed plants. Proline and glycine-betaine accumulation occurred once a threshold turgor was reached, which in Roho appeared to be a reduction by 0.2-0.25 MPa or 30-40 percent. The importance of polyamine accumulation during water stress is discussed. (Peters-PTT)
W86-04700

WATER RELATIONS OF CHROMIUM VI TREATED BUSH BEAN PLANTS (PHASEOLUS VULGARIS) L. CV. CONTENDER) UNDER BOTH NORMAL AND WATER STRESS CONDITIONS,
Universidad Autonoma de Barcelona (Spain). Faculty of Sciences.
For primary bibliographic entry see Field 5C.
W86-04701

WATER TABLE OF ALDER AND NEIGHBOURING ELM STANDS IN A SMALL TRIBUTARY BASIN,
Tohoku Univ., Sendai (Japan). Biological Inst.
H. Fujita, and T. Kikuchi.
Japanese Journal of Ecology, Vol. 34, No. 4, p 473-475, December 1984. 2 fig, 9 ref.

Descriptors: *Water table, *Groundwater availability, *Trees, Japan, Alder trees, Elm trees, Tributaries, Basins, Seasonal variation, Rainfall.

Because water conditions are an important factor in the establishment of alder and elm forests in Japan, the water table in alder and elm forests at the bottom of a small tributary valley is studied. The area is at the base of a small tributary valley dissecting a hilly area near the northwestern end of Miyagi Prefecture, Japan. A thick gravel bed is under the fine surface deposits at the upper end of the study area and elm stands are prominent there, although alder stands sometimes occur the moister areas. The lower end consists mainly of clay and silt with a thin gravel bed, except for the stream side where coarse and fine sands are deposited. This area is usually covered by alder stands, although the stream side is sometimes occupied by elm stands. The seasonal change of groundwater level is related to a number of factors, including rainfall, evapotranspiration and the nature of water movement. Fluctuations recorded in this study depended greatly upon rainfall and excess water from melted snow in late April. Alder stands occurred both at wet sites where the water table was high, regardless of the range of its fluctuation, and where the water table was low and stable. The limit for elm stands could not be determined because only two stands were examined. These stands occupied well-drained sites where the water table was lower than 40 cm. (Peters-PTT)
W86-05188

CONIDIAL FUNGI FROM FRESH-WATER FOAM,
Osmania Univ., Hyderabad (India). Dept. of Botany.
C. Manoharachary, and D. Bhairavanath.
Indian Journal of Botany, Vol. 8, No. 1, p 67-68, June 1985. 1 tab, 2 ref.

Descriptors: *Conidial fungi, *Foaming, Andra Pradesh, India, Anguillosopora crassa, Dactylella aquatica, Freshwater, Streams, Lunulospora curvula, Triscelophorus monosporus.

Foam formed in aquatic ecosystems acts as a trap for many fungal spores and in particular of aquatic Hyphomycetes. Therefore foam samples collected were scanned for a period of one year. Foam samples were collected from some streams of Mancheppa forest locality and of Nizamabad District, Andhra Pradesh, India during 1980-81. Fresh foam and foam samples fixed with a few drops of formalin-alcohol (1 : 5) were scanned under the microscope and identified besides recording their abundance following standard methods. This survey revealed the presence of Anguillospora crassa and Dactylella aquatica with rare occurence, Lunulospora curvula and Triscelophorus monosporus which are more abundant; and clavariopsis aquatica of frequent appearance. However, spores of Beltrania, Curvularia, Drechslera and Tetrapoloa were also observed. A survey of literature revealed that A. crassa, C. aquatica and D. aquatica are the new additions to the Fungi of India. (Lantz-PTT)
W86-05396

MYCO-ECOLOGICAL STUDIES OF TWO WATER-BODIES FROM ANDHRA PRADESH, INDIA,
Osmania Univ., Hyderabad (India). Dept. of Botany.
D. Bhairavanath and, and C. Manoharachary.
Indian Journal of Botany, Vol. 8, No. 1, p 69-78, June 1985. 4 fig, 5 tab, 21 ref.

Descriptors: *Mycoflora, *Water tanks, *Andhra Pradesh, India, Seasonal distribution, Fungi, Monsoons, Rainfall intensity, Hydrogen ion concentration, Organic loading, Achlya, Aphanomyces, Blastocladia, Pythium.

The mycoflora, quantitative information, seasonal variation, distribution and systematics of aquatic Phycomycetes in two freshwater tanks and influence of certain physico-chemical factors on these fungi have been studied. Water samples were collected (March 1980 to February 1981) from two fresh water tanks of Nizamabad District of Andhra Pradesh, India, selected for the present study were designated as Tank A and Tank B, respectively. These were located at 1250 ft and 1500 ft above mean sea level. The sampling sites have experi-

enced monsoon (June to September), Winter (October to January) and summer (February to May) with an average rainfall of 176.46 mm for the year 1980-81 and with a maximum of 377.80 mm in June 1980. Tank water A harbored more fungal population and species than B. Mycoflora was maximum in late monsoon and winter, being least in summer. Achlyas, Pythiums and Phycomycetes other than Saprolegnia were more frequent. Low temperature and high organic contents besides the oxygen contents favored the occurrence, distribution and phenology of aquatic Phycomycetes. A range of pH 8.0 to 8.5 supported good mycoflora than 8.5 to 9.0. Fungal species representing Achlya, Aphanomyces, Blastocladia, and Pythium besides the Allomyces have been isolated. Some species were restricted to a particular tank water and a month/season, while other showed irregular distribution. Fungi have been classified as 'indwellers' and 'transients' as per their completion of life cycles and arrival. (Lantz-PTT)
W86-05397

QUANTITATIVE TECHNIQUE FOR ESTIMATING THE BOUNDARIES OF WETLANDS FROM VEGETATION DATA,
Landplan Collaborative Ltd., Guelph (Ontario).
M. J. Sharp, and P. A. Keddy.
Environmental Management, Vol. 10, No. 1, p 107-112, January 1986. 2 fig, 2 tab, 50 ref.

Descriptors: *Wetlands, *Vegetation, *Surveys, *Boundaries, Marshes, Hydrophytes, St. Lawrence River, Canada, Botanical studies.

A method is proposed for the accurate delineation of the wetlands for planning and conservation purposes. The three-step method is based on vegetation zonation. The first step is to examine transects crossing the transition zone from marsh to upland. In each transect the uppermost occurrence of each plant species is locatedrelative to a fixed survey point. The second step is to determine which of these species are hydrophytes (wetland plants). This is assessed using the presence or absence of morphological and physiological adaptions for growing in wet environments. Alternatively, a literature search using botanical manuals may suffice. The third step determines the upper limit of the wetland by finding the upper limit of the uppermost hydrophyte in each transect, and taking the mean value of these over all transects. This mean defines the boundary of the wetland. The method is illustrated using two marshes (Weston Island and Gray's Creek) along the north shore of the St. Lawrence River in Ontario. It is concluded that this technique fills the need for a low-cost method for delineating wetlands that is scientifically defensible and can be employed on relatively small wetlands. (Peters-PTT)
W86-05411

2J. Erosion and Sedimentation

MORPHOLOGY OF A DELTA PROGRADING BY BULK SEDIMENT TRANSPORT,
Cornell Univ., Ithaca, NY. Dept. of Geological Sciences.
P. M. Kenyon, and D. L. Turcotte.
Geological Society of America Bulletin BUGMA, Vol. 96, No. 11, p 1457-1465, November 1985. 14 fig, 2 tab, 42 ref. NSF EAR 81-21053.

Descriptors: *Deltas, *Sediment transport, *Geomorphology, *Mathematical models, *Progradation, Mississippi River, Fraser River, Rhine River, Lake Constance, United States, Canada, Creep, Landslides, Lake Sediments.

A theoretical geomorphic model is developed for the propagation of a river delta in which the patterns of deposition and movement of sediment on the delta front slope are dominated by bulk-transport processes, such as creep and landsliding. The model predicts an exponential delta front profile, in which the maximum slope is controlled by the sediment supply to the delta, the rate of sediment transport on the delta front slope, and the depth of the receiving basin. Applications of the model to the Fraser and Mississippi River deltas and to the Rhine River delta in Lake Constance give good agreement with the progradation and morphology of these deltas. A difference in transport coefficient between the Mississippi River and the other deltas is attributed to the differences in sediment composition and/or rate of sediment supply between this and the other deltas. The derived sediment-transport coefficients are found to be much higher than those for subaerial hillslopes. The results suggest that deltas prograding by the processes considered in this paper will adjust quickly in sediment supply. (Author's abstract-PTT)
W86-04702

ANALYSIS OF STRATIGRAPHIC CONTROL ON RIVER BANK FAILURE,
Nigeria Univ., Nsukka. Dept. of Geology.
For primary bibliographic entry see Field 4D.
W86-04748

RIVER MECHANICS,
University of East Anglia, Norwich (England). School of Environmental Sciences.
R. D. Hey.
Institution of Water Engineers and Scientists, Journal, Vol. 40, No. 2, p 139-158, April 1986. 10 fig, 1 tab, 44 ref.

Descriptors: *River mechanics, *River beds, *River engineering, Mathematical models, Secondary flows, Shear stress, Flow resistance, Bed load, Bank erosion, Bank protection, River channels, Channel capacity, Dredging, Channelization, Outfalls, Intakes, Natural channel design, Mountains, Sediment transport, Meanders.

A review of recent research on river mechanics and its application to river engineering practice includes: dynamic process-response models of gravel-bed river development, secondary flows, boundary shear stress, flow resistance bedload transport, bank erosion, meander mechanisms, regime dimensions of gravel-bed rivers, dominant discharge, dynamic modeling of river channels, channel capacity, dredging, widening/narrowing, and straightening, flood banks and two-stage channels, bank protection, river outfalls and intakes, natural channel design, and river response to changes in discharge and sediment load. In mountainous areas, or proglacial zones, where gravel bed rivers are inherently unstable, particular care has to be exercised in the design and construction of river engineering works in order to minimize their impact on channel stability. Stable gravel-bed rivers are more tolerant of such changes. In contrast, stable sand-bed rivers are highly vulnerable because of high transport rates and the absence of armoring. (Rochester-PTT)
W86-04750

EROSION AND SEDIMENT TRANSPORT MEASUREMENT: SYMPOSIUM.
Institute of Hydrology, Wallingford (England).
Available from IAHS, 2000 Florida Ave., NW, Washington, DC. 20009, Price: $40.00. IAHS-AISH Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. 527 p.

Descriptors: *Sediment transport, *Erosion, Sampling, Measuring instruments, Suspended sediments, Bed load, Rivers, Rainfall, Runoff, Sediment yield, Landslides, Soil mechanics, Bank erosion, Soil loss, Soil erosion, Monitoring, Model studies, Sediment load.

This symposium concerns two main topics: measurement of sediment transport and measurement of erosion. Papers on sediment transport measurement are grouped into several categories: bed load transport, continuous monitoring of suspended sediment concentrations, suspended sediment sampling apparatus, suspended sediment sampling techniques, debris flows and landslides, and design of data collection programs. Papers on erosion measurement include rainfall erosivity and splash erosion, rainfall simulators, erosion plot studies, and field measurement or erosion. (See W86-04844 thru W86-04894) (Cassar-PTT)
W86-04843

MEASUREMENT OF BED LOAD IN RIVERS,
Oregon State Univ., Corvallis. School of Forestry.
W. W. Emmett.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 3-15, 3 fig, 4 tab, 4 ref.

Descriptors: *Sediment transport, *Bed load, *Sampling, *Rivers, Erosion, Particle size, Helley-Smith sampler, Sediment load, Sedimentation.

The Helley-Smith bed load sampler is a direct measuring, pressure differential sampler designed for use with sediment ranging in size from coarse sand to medium gravel. For sediment particle sizes between 0.50 and 16 mm, the Helley-Smith bed load sampler has a near-perfect sediment trapping efficiency. For particle sizes smaller than 0.50 mm or larger than about 16 mm, inadequate sampling procedure for many rivers consists of sampling bed load at about 20 equally-spaced transverse locations on each of two transverse across the river. This procedure enables determination of mean bed load transport rate as well as providing insight to spatial and temporal variations in transport rate. (See also W86-04843) (Author's abstract)
W86-04844

INCREASED BAG SIZE IMPROVES HELLEY-SMITH BED LOAD SAMPLER FOR USE IN STREAMS WITH HIGH SAND AND ORGANIC MATTER TRANSPORT,
R. L. Beschta.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 17-25, 3 fig, 1 tab, 12 ref.

Descriptors: *Sediment transport, *Bed load, *Sampling, *Rivers, Erosion, Particle size, Helley-Smith sampler, Sediment load, Sedimentation, Sand, Organic matter, Flumes.

Flume measurements showed that the sampling efficiency of the Helley-Smith bed load sampler rapidly decreased as sands clogged the 0.2 mm mesh of a standard bag (surface area = 1950 sq cm). Sampled transport rates were consistently low in relation to ambient rates of sediment transport. For sampling intervals of 4 and 145 min, sampling efficiencies averaged 20 and 14%, respectively. Because the change in efficiency was nonlinear with time, transport rates computed from samples collected over a variety of sampling times should not be compared directly. A three-fold increase in bag surface area prevented the rapid decline in sampling efficiences, and calculated transport rates were within a few percentage points of ambient rates. Instream measurements further indicated that organic matter decreases the sampling efficiency of the standard bag, another problem minimized by the use of a larger bag. (See also W86-04843) (Author's abstract)
W86-04845

EFFICIENCY OF BASKET TYPE BED LOAD SAMPLERS,
National Water Research Inst., Burlington (Ontario).
P. Engel, and Y. L. Lau.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 27-34, 4 fig, 2 tab, 12 ref.

Descriptors: *Sediment transport, *Bed load, *Sampling, *Rivers, Erosion, Particle size, Sediment load, Sedimentation, Basket samplers, Flumes.

The sampling efficiencies of three models of basket samplers were studied in a sediment flume. Dimensions of the samplers (in cm) were 3.8 x 8.8 x 11.5, 5.0 x 11.7 x 15.3, and 7.6 x 17.6 x 23.6. Results, together with analysis of data from the literature, indicate that the sampling efficiency of basket samplers is not constant but may be a function of two dimensionless variables. The hydraulic efficiency, which should be constant for accurate sampling, decreased as the basket sampler filled with sedi-

ment. Therefore, calibration curves are necessary to obtain bed load transport using basket samplers. (See also W86-04843) (Cassar-PTT)
W86-04846

DEVELOPMENT OF A SAND BED LOAD SAMPLER FOR THE YANGTZE RIVER,
Yangtze River Planning Office, Hankou (China).
Z. Dejia, L. Daorong, and G. Haochuan.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of teh Florence Symposium, June 22-26, 1981. p 35-46, 11 fig, 2 tab.

Descriptors: *Sediment transport, *Bed load, *Sampling, *Rivers, Erosion, Particle size, Sediment load, Sedimentation, Sand, Yangtze River, Polyakov bed load sampler, Netherlands bed load sampler, Don bed load sampler, Flow velocity, China.

Several bed load samplers used in the Yangtze River during the 1950's are described. The Polyakov sampler, which has a collecting trap, leading plate, and tail vane, has an efficiency of 19.9% under slower stream velocities. The Netherlands (or Dutch sampler) has a mesh bag with much resistance to flow and an efficiency of 17.5%. It also produces a large scour hole. The Don sampler, a pressure-difference type, has a trapping efficiency of 46.5%. The contact plate loses contact with the bed in a few seconds and produces scour holes in front. Criteria for a satisfactory bed load sampler include a good fit between the lower edge of the sampler entrance and the stream bed without causing erosion or deposition, a 1.0 ratio of intake velocity to natural stream velocity, and high trapping efficiency. Two samplers were designed, based on these desirable characteristics. The ratio of intake to stream velocity and the trapping efficiency were 86.1 and 43.5%, respectively, for the Yangtze 73 sampler and 1.05 and 61.4% for the Yangtze 78 sampler. Both have a 100 x 100 mm entrance, protective plates to maintain contact with the stream bed, and are designed to reduce flow velocity within the sampler to allow representative sampling. (See also W86-04843) (Cassar - PTT)
W86-04847

EXPERIMENTAL INVESTIGATIONS ON THE INITIATION OF BED LOAD TRANSPORT IN GRAVEL RIVERS,
Pisa Univ. (Italy). Facolta di Ingegneria.
S. Cavazza.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 53-61, 3 fig, 1 tab.

Descriptors: *Sediment transport, *Bed load, *Rivers, Gravel, Floods, Tracers, Flow velocity, Turbulent flow, Shields curve.

This report presents the results of research carried out on gravel river beds, composed of fractions of up to 350 mm, and the conditions of initial bed load transport. The method employed is applicable to rivers with short duration floods and significant periods of low water. It comprises the following elements: topographical survey of the geometry of the river bed; granulometric analysis of the bed material; selection of round pepple tracers, the measurement of orthogonal circumferences, weight and volume; coloring and numbering of tracers; placing of tracers moved after every flood and, where possible, measurement of displacement. This report presents the results of experiments carried out on six marked sections. The data obtained have permitted the testing of theoretical formulae for bed load transport at these sites and the verification of the Shields curve in cases of extreme turbulence. (See also W86-004843) (Author's abstract)
W86-04848

NUCLEAR TECHNIQUES FOR MEASURING SEDIMENT TRANSPORT IN NATURAL STREAMS, EXAMPLES FROM INSTRUMENTED BASINS,
Naples Univ. (Italy). Ist. di Geologia e Geofisica.
G. S. Taziolo.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 63-81, 16 fig, 25 ref.

Descriptors: *Isotopic tracus, *Measuring instruments, *Sediment transport, *Streams, Radioactive tracers, Nuclear gages, Gages, Erosion, Floods, Suspended sediments, X-ray, Gamma radiation.

Nuclear gages are useful for measuring bed load transport in torrential streams with very high suspended sediment concentrations (1 to 200-300 g per liter). These instruments use the absorption or diffusion of x-ray or gamma radiation by an artificial radiation source, or alternatively, on the measurement of natural gamma radioactivity emitted by the suspended sediment. Nuclear techniques cause minimum disturbance of water flow. Factors which influence measurements are temperature, chemical composition of the sediments, and electronic drift. Nuclear gages (Am241 and Cs137) were used in two instrumented basins in southern Italy, where floods are common in the short rainy season. Data indicated a reasonable degree of correlation between discharge and suspended sediment loads for 15 flood events. Tracers for studying sediment movement are described. In general, Au198 is used for preliminary experiments and longer-lived Cr51, Ir192, Sc46, and Ta182 for later stages. Activities vary from a few millicuries to 150 Ci. The mass of radioactive sediment emplaced varies from a few dozen for pebble-sized material to several kilograms for pelitic sediment and sand. Particles are labeled by coating the surface or, in larger materials, depositing the tracer in drilled holes. (See also W86-04843) (Cassar - PTT)
W86-04849

DEVELOPMENT OF NUCLEAR SEDIMENT CONCENTRATION GAUGES FOR USE ON THE YELLOW RIVER,
Yellow River Conservancy Commission, Zhengzhou (China). Inst. of Hydraulic Research.
L. Zhi, L. Yuren, S. Leling, X. Xianglin, and Y. Yujing.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 83-90, 7 fig, 4 ref.

Descriptors: *Sediment transport, *Measuring instruments, *Rivers, *Suspended sediment, Yellow River, China, Nuclear gages, Gages, Isotopic tracers.

Three types of nuclear sediment concentration gages were developed for use on the Yellow River, China. The instrument designed for measuring hyperconcentrations was based on the principle of gamma scattering, using a Geiger counter with a tungsten cathode and a transistorized quench circuit. Radioactive sources were Cs137, and for accuracy at lower concentrations, Am241. Results of horizontal sampling and the radioisotope method agreed closely for sediment concentrations between 15 and 500 kg per cu m. Lower sediment concentrations were measured with two types of probes: scintillation detector and proportional counter detector. (See also W86-04843) (Cassar - PTT)
W86-04850

LATEST ACHIEVEMENTS IN THE DEVELOPMENT OF NUCLEAR SUSPENDED SEDIMENT GAUGES,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
B. Berke, and L. Rakoczi.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 91-96, 2 fig, 2 ref.

Descriptors: *Sediment transport, *Measuring instruments, *Rivers, *Suspended sediments, Nuclear gages, Gages, Hungary, Floods.

In situ measurement of suspended sediment concentrations is especially important at higher concentrations, i.e., during floods or in countries where streams have very high sediment transport capacity. The new Hungarian nuclear gage for measuring suspended sediment includes previously developed features like the horizontal arrangement, the capability of taking measurements close to the bed, and an adjustable distance between the radiation source and the detector. In addition, it has the following new features: (a) a semiconductor detector instead of a scintillation detector, enabling a lower supply voltage to be used, and having tolerance of voltage fluctuations; (b) a built-in programmable pocket calculator which directly converts measured radiation intensity into sediment concentration. The range of measurement of the gage is about 500-12000 mg per liter, high enough for most semiarid or tropical streamflow conditions. Because it is battery-powered and portable, the gage can be rushed to the site of a sudden flood. (See also W86-04843) (Author's abstract)
W86-04851

CONTINUOUS MEASUREMENT OF SUSPENDED SEDIMENT IN RIVERS BY MEANS OF A DOUBLE BEAM TURBIDITY METER,
Hydrological Research Inst., Pretoria (South Africa).
D. C. Grobler, and A. V. B. Weaver.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 97-103, 4 fig, 1 tab, 8 ref.

Descriptors: *Sediment transport, *Measuring instruments, *Suspended sediments, *Turbidity, Rivers, Double beam turbidity meter, Monitoring.

A turbidity meter for continuous monitoriong of suspended sediment concentrations in rivers is described. The measuring principle automatically compensates for detector and light source aging as well as for the accumulation of dirt and algae on the sensor windows. Data are recorded on a Read Only Memory (ROM) device which plugs into the instrument. After a ROM is full, it is replaced and the ROM with the data is connected to a computer. The data are read directly onto a disc file. The ROM is cleared by passing it under an ultraviolet light after which it is ready for reuse. The instrument has an intelligent receiver unit which can be programmed to vary integration times, measuring frequencies and recording frequencies as a function of information received from the turbidity sensor or other sensor connected to it. Initial laboratory and field tests indicate that the instrument is accurate and measures over a wide sediment concentration range (0-8 g per liter). This combination of features makes this a highly suitable instrument for monitoring sediment concentrations for the purpose of calculating sediment discharge in rivers. (See also W86-04843) (Author's abstract)
W86-04852

USE OF TURBIDITY MONITORS TO ASSESS SEDIMENT YIELD IN EAST JAVA, INDONESIA,
Hydraulics Research Station, Wallingford (England).
T. E. Brabben.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 105-113, 4 fig, 3 tab, 10 ref.

Descriptors: *Sediment transport, *Suspended sediments, *Turbidity, *Sediment yield, Rivers, Monitoring, Reservoirs, Silting, Reservoir silting, Karangkates Reservoir, Selorejo Reservoir, Java, Indonesia, Brantas River, Partech turbidity monitor, Erosion.

Sediment loss from the drainage basins of two reservoirs, Karangkates and Selorejo, in the River Brantas basin, East Java were studied. Since 1977 up to eight Partech turbidity monitors have been used to record continuous output of suspended sediment concentration at river flow measuring points within the drainage basins. Measurements of rainfall intensity and streamflow were made at the same time. Surveys of the reservoirs were undertaken to determine the quantity and distribution of

the sediment deposits. Turbidity monitors had a high mechanical failure rate (30% of records lost) due to high temperatures, humidity, and slow maintenance. Sediment yields calculated from turbidity monitoring data were much lower than those estimated from reservoir surveys. The discrepancy is caused by lack of data collected in the severe flood stages and lack of bed loads. (See also W86-04843) (Cassar - PTT)
W86-04853

ANALYSIS OF A SIMPLE SUSPENDED LOAD INTEGRATING SAMPLER,
Florence Univ. (Italy). Dept. of Civil Engineering.
I. Becchi, P. Billi, and P. Tacconi.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 115-122, 10 fig, 2 ref.

Descriptors: *Sediment transport, *Measuring instruments, *Suspended sediments, *Sampling, Filtering bag integrating sampler, Filters.

The filtering bag integrating sampler for suspended sediment comprises a perforated metal cage, a tea bag paper filtering bag, and a molded polyethylene nozzle. Filtering efficiency results with two weights of nonwoven filter paper were widely scattered. Further testing showed that type T paper, weight 17 g/sq m, produced more scattered data than type B paper, weight 25 g/sq m. Slight variations in nozzle shape produced large changes in the behavior of the sampler. Relationships were developed between the filtering efficiency and the diameter of the sediment. (See also W86-04843)(Cassar - PTT)
W86-04854

RECENT DEVELOPMENTS IN PUMP SAMPLERS FOR THE MEASUREMENT OF SAND TRANSPORT,
Hydraulics Research Station, Wallingford (England).
M. J. Crickmore, and C. J. Teal.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 123-130, 3 fig, 3 ref.

Descriptors: *Sediment transport, *Measuring instruments, *Sand, *Sampling, Suspended sediments, Pump samplers, Sand fluctuations.

It continues to be the practice of the Hydraulics Research Station to compute suspended sand fluxes in rivers and estuaries from depth profiles of sediment concentration and velocity. The profiles are defined by point measurements using pump samplers and current meters. Special bed frames are described that have been designed to allow reliable positioning of the sampling intake and the current meter with reference to the bed surface. On-site extraction of the sediment is obtained by filtration or by hydrocyclone. The flux of individual size fractions is computer by combining the best-fit profiles of velocity and concentration. Specimen results for river and tidal flow are given. (See also W86-04843) (Author's abstract)
W86-04855

FIELD MEASUREMENTS OF SUSPENDED SEDIMENT CONCENTRATION IN THE SURF ZONE,
Polish Academy of Sciences, Gdansk. Inst. Budownictwa Wodnego.
T. Basinski.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 137-143, 3 fig, 1 tab, 4 ref.

Descriptors: *Sediment transport, *Measuring instruments, *Suspended sediments, *Sampling, Surf, Sand, Sand trap, Suction sampler, Radioisotope probe.

Three methods of measuring suspended sand concentrations were compared in field tests. These include a sand trap, a suction sampler, and a radioisotope probe. Among the sources of measurement error are distortion of the flow pattern by the device; temporal variations in salinity and other water quality parameters; composition, size distribution, and shape of sand grains; organic matter, air bubbles; variations in sea level and shifting sea bed; equipment faults; insufficient calibration; and unappropriate and insufficient measuring points. A list of requirements for measurement methods is given. Evaluation of the three samplers is presented in table. Although all of them can be used in practice, the cost, sensitivity, ease of calibration, and integration time must be considered for each situation. (See also W86-04843) (Cassar - PTT)
W86-04856

IN SITU MEASUREMENTS OF PARTICULATE MATTER TRANSPORT IN RIVERS,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Siedlungswasserwirtschaft.
B. Doll, H. H. Hahn, and F. Kaser.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 145-150, 2 fig, 2 tab, 3 ref.

Descriptors: *Sediment transport, *Rivers, *Particulate matter, *Suspended sediment, *Sampling, Mixing, Neckar River, Federal Republic of Germany, Ecograph.

In order to apply models describing mixing and transport phenomena in natural systems, data of a very specific nature are required. The program of an investigation undertaken for more than two years in the River Neckar has been determined to a large extent by the concept of a model developed in parallel. Prerequisites for the collection of in situ data include a specially equipped boat, which permits the collection of data by means of various electrodes as well as by sampling. The continuous measuring equipment as well as the sampling device are supplied by a continuous flow of water pumped into the laboratory installed on the boat. Samples are either analyzed there, in an accompanying field laboratory ashore, or in the central laboratory of the research institute. The overall geometry of river cross sections was recorded by an echograph. (See also W86-04843) (Author's abstract)
W86-04857

SEDIMENT MEASUREMENT TECHNIQUES USED BY THE SOIL CONSERVATION SERVICE OF NEW SOUTH WALES, AUSTRALIA,
Soil Conservation Service of New South Wales, Sydney (Australia).
K. T. Ryan.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 151-157, 12 ref.

Descriptors: *Sediment transport, *Measuring instruments, *Sampling, Runoff, Geib sampler, Flow splitting, Wheel sampler, Pomerene sampler, Pumping samplers, Gamet water sampler, Flow control, Pumping sampler, New South Wales, Australia, Crump weirs, H flumes.

The Soil Conservation Service of New South Wales uses two sediment sampler systems. The first uses a sediment sampler to provide an estimate of both sediment concentration and total runoff. The second system uses a sediment sampler to give an estimate of sediment concentration and a supplementary instrument to give the total runoff estimate. Criteria for choosing a sampler for a particular application are capacity, sample size and type, accuracy, reliability, cost, and hydraulic head. Geib multislot divisors and storage tanks are used to estimate total sediment yield, on an event basis, from small plots. Pomerene wheels and H flumes are used in small basins. When discrete samples are required for soil erosion process research, or from medium to large basins, pumping sediment samplers are used. The sampler intake point is located downstream of a turbulent section of flow or a depth integrating tube is used to obtain representative samples. The flow measuring structures used with pumping samplers are either sloping crest Crump weirs or H flumes with 14% sloping drop boxes. (See also W86-04843) (Cassar - PTT)
W86-04858

SEDIMENT TRANSPORT SAMPLING FOR ENVIRONMENTAL DATA COLLECTION,
Water and Power Resources Service, Denver, CO.
For primary bibliographic entry see Field 7B.
W86-04859

SEDIMENT SAMPLING IN RIVERS AND CANALS,
Uttar Pradesh Irrigation Research Inst. Roorkee (India).
For primary bibliographic entry see Field 7B.
W86-04860

RELIABILITY OF SUSPENDED SEDIMENT LOAD DATA,
Exeter Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 7C.
W86-04861

ACCURACY AND PRECISION OF SUSPENDED SEDIMENT LOADS,
Guelph Univ. (Ontario). School of Engineering.
For primary bibliographic entry see Field 7C.
W86-04862

STUDY OF THE VARIABILITY OF SUSPENDED SEDIMENT MEASUREMENTS,
Agricultural Research Service, Chickasha, OK.
For primary bibliographic entry see Field 7B.
W86-04863

ACCURACY OF ESTIMATING BASIN DENUDATION PROCESSES FROM SUSPENDED SEDIMENT MEASUREMENTS,
Institute of Meteorology and Water Management, Warsaw (Poland).
J. Branski.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 213-218, 5 ref.

Descriptors: *Sediment transport, *Erosion, *Sediment yield, *Suspende sediments, *River basins, Denudation, Poland, Statistical analysis.

It is obvious that estimations of denudation rate have a systematic (negative) error resulting from not having taken into account (a) bed and dissolved load, and (b) that part of the denudation product which does not reach rivers but remains in storage in the landscape. These estimations have random errors which depend on the method used to measure suspended load, the method of calculating sediment concentration, the method of calculating sediment yield, etc. By establishing the elementary random errors by statistical analysis it is possible to calculate the accuracy of denudation indices. An assessment is presented using data from Polish rivers, both for simple basins (source to measuring point) and incremental basins (between measuring points); errors are 4 times larger for the latter calculation. (See also W86-04843) (Author's abstract)
W86-04864

TECHNIQUES APPLIED IN DETERMINING SEDIMENT LOADS IN SOUTH AFRICAN RIVERS,
Pretoria Univ. (South Africa). Dept. of Civil Engineering.
A. Rooseboom, and G. W. Annandale.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 219-224, 3 fig, 10 ref.

Descriptors: *Sediment transport, *Sediment yield, *Erosion, *South Africa, Rivers, Reservoirs, Sediment load, Mathematical studies.

Since 1920 sediment loads in southern African rivers have been measured with daily bottle sam-

pling and measurement of sediment deposit volumes. Bottle samples usually yield results about 25% lower than those obtained with more sophisticated methods. Limited bed load sampling indicated that most of the sediment load in these rivers is suspended. Sediment yield was successfully depicted by applying the double mass curve of cumulative sediment discharge against cumulative water discharge. Reservoir sediments were calculated from the measured volume, assuming all deposits were 50 years old with a density of 1350 kg/cu m. A sediment yield map of South Africa was prepared. (Cassar - PTT)
W86-04865

MEASUREMENT OF DEBRIS FLOW AND SEDIMENT-LADEN FLOW USING A CONVEYOR-BELT FLUME IN A LABORATORY,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 7B.
W86-04866

SOME PROBLEMS RELATED TO SEDIMENT TRANSPORT MEASUREMENT IN STEEP MOUNTAIN STREAMS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
F. Raemy, and M. Jaeggi.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p. 231-239, 6 fig, 5 ref.

Descriptors: *Sediment transport, *Streams, *Mountains, Flumes, Sediment load, Sediment scale, Sediment-water interfaces.

A sediment-scale was developed to record continuously the variation of a sediment load with time, as applied to steep mountain streams with very high sediment concentrations and unsteady phenomena in bed erosion processes. The scale measures the forces exerted by the water-sediment mixture on a steel slab inserted in the flume bottom. Knowing the weight of the mixture, worked out from calibrated extensiometers supporting the slab, the height of the water table over the flume bottom and the mean velocity of the sediment, the instantaneous sediment transport rate can be found. Tests were conducted with a flow discharge of 7.4 liters/sec, a slope of 2%, and masses of 2 and 4 kg of widely graded sediment introduced at the upstream end of the flume. Introducing the sediment disturbed the flow by causing the water surface level to fall for the first 5 sec. The sediment velocity was almost constant throughout the passage of sediment, i.e., it did not change significantly with sediment concentration. (See also W86-04843) (Cassar - PTT)
W86-04867

INTEGRATED DEBRIS FLOW OBSERVATIONS,
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
S. Okuda, T. Aoki, and M. Okamoto.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 241-244.

Descriptors: *Sediment transport, *Soil mechanics, *Erosion, *Landslides, Mountains, Mt. Yakedake, Kamikamihori Valley, Japan, Debris flows, Photography, Rainfall, Rain gages, Flow meters.

Debris flows in the Kamikamihori Valley east of Mt. Yakedake (2455 m), Japan, have been studied using rain gates, directional rain gages, and groundwater level meters in the debris source areas; investigation of the flow mechanism with fluid speed meters, impact force recording devices, soil samplers, seismographs, 8 mm movie cameras, and video cameras in the fan area. Automatic sensors turn on the equipment when the debris flows start, usually from rainfall. Photography conditions are extremely difficult because most rainfall and debris flows occur at night or in heavy fog. Fifty-three flows have been observed in the past 10 years. (See also W86-04843) (Cassar - PTT)
W86-04868

STUDIES OF SEDIMENT PRODUCTION ON MOUNTAIN SLOPES,
Kyoto Univ. (Japan). Faculty of Agriculture.
For primary bibliographic entry see Field 4D.
W86-04869

NEW METHODS OF MEASUREMENT OF SLOW PARTICULATE PROCESSES ON HILLSIDE SLOPES,
London School of Economics and Political Science (England). Dept. of Geography.
For primary bibliographic entry see Field 7B.
W86-04870

SEDIMENT MEASUREMENT IN THE YELLOW RIVER,
Yellow River Conservancy Commission, Zhengzhou (China).
L. Yuqian, and X. Guishu.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 275-285, 7 fig, 4 tab, 5 ref.

Descriptors: *Sediment transport, *Erosion, *Rivers, Sediment deposition, Deposition, Sediment yield, Yellow River, China, Networks, Reservoirs, Reservoir silting, Silting, Floods, Sediment concentration, Soil loss, Alluvial rivers.

The development of sediment measurement networks on the Yellow River, China, are reviewed. This river is characterized by a very high sediment load and a relatively limited volume of water. Long-term data collection has revealed the main source area of sediment yield and the quantity of sediment transported, deposited, and diverted. Some records date to the third century AD. Although only 33 hydrometric stations existed in 1949, 456 stations operate today. The river is studied in four sections, based on channel pattern - wandering, transition, meandering, and estuary. Thirty-six percent of the total sediment is >50 microns in diameter; 3/4 of it originates from an area of 100,000 sq km (total basin area is 752,000 sq km). About 50-90% of the total sediment is delivered within 10 days of floods. Only 24% of the silt passes through the system into the sea, leaving 43% in the delta. Geomorphological changes in the lower river during floods are drastic, making hydrometric measurements difficult. Reservoir sedimentation is a severe problem in the 140 reservoirs on the river. This is being controlled by removing sediment-laden water for irrigation and regulating flow so that the muddy water is kept moving through the system. Accuracy of methods for measuring sediment transport is described, considering the hyperconcentrations of sediment and the wide temporal variations in the river system. (See also W86-04843) (Cassar - PTT)
W86-04871

MEASUREMENT OF SEDIMENT YIELD AND TRANSPORT IN MOUNTAIN TORRENTS IN JAPAN,
Public Works Research Inst., Tsukuba (Japan).
T. Mizuyama, and M. Watanabe.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 287-294, 8 fig.

Descriptors: *Sediment transport, *Rivers, *Sediment yield, *Sampling, Mountains, Dams, Sedimentation, Sabo dams, Japan, Bed load, Erosion, Particle size, Erosion control.

Sabo (erosion control) dams and reservoirs are used in Japan as large bed load traps to measure sediment yield in mountainous streams where customary methods are ineffective. Types of measurements for this system include rainfall, flow discharge, sediment concentration of wash load and suspended load, river bed elevation changes, sediment production caused by erosion and landslides (from aerial photographs), sediment yield from experimental plots (bare and vegetated), and grain size distribution. Equations are given for the relationship of sediment concentration of wash load to flow discharge. Studies of grain size distribution show that the finest particles, often not detected, are vital for successful completion of sediment mass balances. Reservoir sedimentation data must consider the variations in the trapping efficiency of each site and the density of sediments. (See also W86-04843) (Cassar - PTT)
W86-04872

MEASUREMENT OF SUSPENDED SEDIMENT AND BED LOAD IN SAND BED CHANNELS AND THE ASSOCIATED PROBLEMS,
Illinois State Water Survey Div., Champaign.
N. G. Bhowmik.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 295-303, 5 fig, 6 ref.

Descriptors: *Sediment transport, *Erosion, *Bed load, *Suspended sediments, *Sampling, *Erosion rates, Sand, Kankakee River, Illinois, Bank erosion, Illinois River, Navigation, Barges.

Problems faced in the measurement of erosion and sediment transport are described for four case studies. (1) Sediment transport in the Kanakee River was measured with a Helley-Smith bed load sampler, used with caution because it could easily sink in the sandy bottom and because the sampler was designed to measure much larger particles. Maximum water discharge and maximum sediment load correlated well in some cases, but not in others, showing that isolated samples may not be reliable. The relationship between sediment yield and water yield varied considerably with the season. Although the suspended sediment was sand in the spring flood, silt, clay, and very fine sand was carried in late summer and fall. (2) Bank erosion in the Illinois River was successfully documented by measuring the bank slopes at a few cross sections and surveying the bank along the selected reaches. (3) Lateral movement of suspended sediment in the presence of barge traffic in the Illinois River was studied at a shore station and barge track station. Concentrations of suspended sediment (mg/liter) increased from 60 (background) to 500 when the first barges passed and back to 90 after 4 barges had passed. (4) A sampling schedule for suspended sediment concentrations in the Kanakee River was devised, considering that 70-90% of the annual suspended sediment load passed during the 60-90 day flood season. (See also W86-04843) (Cassar - PTT)
W86-04873

SIGNIFICANCE, MEASUREMENT, AND ANALYSIS OF SEDIMENT DISCHARGES OF FLASHY STREAMS,
Irrigation and Power Research Station, Amritsar (India).
G. S. Dhillon, V. S. Sakhuja, and T. C. Paul.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 305-313, 5 fig, 22 ref.

Descriptors: *Sediment transport, *Streams, *Suspended sediments, *Bed load, *Sampling, India, Flashy streams, Sediment load, Bed load samplers, Acoustic instruments, Ultrasonic method, Punjan bottle sampler, Mathematical studies.

Standard methods for measuring sediment loads are limited when applied to flashy streams carrying very large suspended sediment loads. Mean sediment concentrations may vary up to 70% in a vertical. Some other problems are as follows: ultrasonic scattering method -- severely disturbed by air bubbles and restrictions on the upper limit of sediment concentration; bed load samplers -- do not stay in place in the raging torrents; acoustic instruments -- measure only the relative bed load transport in the cross section and relative variations with time in streams having coarse bed material; ultrasonic method -- relies on questionable assump-

tions. A complete trench across a river appears to be reliable for measuring bed load. Five flashy streams were sampled from overhanging cableways or bridges, using the Punjab bottle sampler fitted with appropriate weights. Suspended sediment samples were taken in three verticals at 1/6, 1/2, and 5/6 of surface width; at the surface in high flood stages. A Russian type sampler with an efficiency of 73% was used for bed load sampling. Of five sediment discharge formulae (DuBoys-Straub, Shields, Colby, Laursen, and Engelund-Hansen), the DuBoys-Straub formula had the least standard error. (See also W86-04843) (Cassar - PTT)
W86-04874

NATIONAL EROSION INVENTORY OF THE SOIL CONSERVATION SERVICE, US DEPARTMENT OF AGRICULTURE, 1977-1979,
Soil Conservation Service, Washington, DC.
For primary bibliographic entry see Field 7C.
W86-04875

DATA REQUIREMENTS FOR SEDIMENT, EROSION AND TRANSPORT SIMULATION,
University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering.
For primary bibliographic entry see Field 7A.
W86-04876

UPLAND EROSION: EVALUATION AND MEASUREMENT,
Istituto Sperimentale per lo Studio e la Difesa del Suolo, Florence (Italy).
G. Chisci.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 332-349, 1 fig, 4 tab, 58 ref.

Descriptors: *Erosion, *Soil erosion, *Model studies, *Sediment transport, Mathematical models, Soil loss, Hill erosion, Rainfall, Runoff, Rainfall simulators, Universal Soil Loss Equation, Microscale measurements.

The connection between experimental research and mathematical models in assessing and forecasting upslope soil erosion are described. Although erosion occurs on macro- and mesoscales, this paper is confined to microscale measurements (hill slopes, soil depth loss vs. different erosion type, and soil fertility). Soil erosion depends basically on the power of the rain to cause erosion (erosivity) and the ability of the soil to withstand the rain (erodibility). Subsidiary factors are soil morphology, vegetation cover, and land management. Erosion, erosivity, and erodibility can be separated into components. From these, a basic conceptual model is derived. The Universal Soil Loss equation was developed to express annual soil loss in terms of the components. Modifications in the factors can fit this equation for use in other countries. Newer models such as CREAMS and the gross erosion sediment delivery method provide more accurate predictions. Experimental plots are used to measure erosion and collect rainfall-runoff data. These studies involve techniques and equipment such as flow shear stress, splash cups, bounded runoff plots, surface level measuring devices, and rainfall simulators. (See also W86-04843) (Cassar-PTT)
W86-04877

ANALYSES OF DIFFERENT PROCESSES GOVERNING SOIL EROSION BY WATER IN THE TROPICS,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
R. Lal.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 351-364, 3 fig, 5 tab, 42 ref.

Descriptors: *Erosion, *Soil erosion, *Sediment transport, *Tropical regions, Rainfall, Africa, Land use, Soil properties, Organic matter, Slopes, Soil loss, Alfisols, Nigeria.

Factors concerned with soil erosion in Africa are described: soil erodibility, rainfall erosivity, slope factor, and soil loss tolerance. Available research on soil, climate, and land use is rather sketchy. It indicates that the severity of the erosion hazard may be attributed to soil characteristics, low soil loss tolerance, and climatic factors that lead to accelerated soil erosion following a change in land use. For some soils in Nigeria, organic matter content and cation exchange capacity were related to soil erodibility. A table lists the soil erodibility indices of several African soils. Soil loss tolerance ranges (theoretically) from 2.5 to 12.5 tons/ha/year, depending on soil characteristics, and is extremely low in the shallow tropical soils with limited rooting depth. For example, a soil loss of 0.1-0.5 t/ha per year in western Nigerian alfisols may cause a 50% yield reduction in 50-100 years. (See also W86-04843) (Cassar-PTT)
W86-04878

STUDY OF THE DYNAMICS OF DROP EROSION UNDER LABORATORY CONDITIONS,
Lajos Kossuth Univ., Debrecen (Hungary).
A. Kerenyi.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 365-372, 5 fig, 4 tab, 2 ref.

Descriptors: *Erosion, *Soil erosion, Erosion control, *Drop erosion, Rainfall simulators, Sand, Kazo rainfall simulator, Statistical analysis.

Drop erosion experiments on sand were carried out with a Kazo type rainfall simulator. The linear correlation between rainfall energy and material displaced was examined by least squares analysis. This defined the energy range at which there is no material transfer (i.e., the range below the drop erosion threshold energy). The threshold energy for sand maintained in a state of humidity in balance with atmospheric humidity (0.4 weight percent) is 500-620 ergs; for sand with a moisture content of 20-22 weight percent (typical of conditions at the end of a rainstorm), 50-120 ergs. The order of magnitude of material transfer corresponding to an infinite falling height has also been evaluated. A plastic net with 1 mm mesh stretched over the soil surface reduced material transfer 33- to 55-fold. (See also W86-04843) (Cassar-PTT)
W86-04879

FIELD MEASUREMENT OF SPLASH EROSION,
National Coll. of Agricultural Engineering, Silsoe (England).
R. P. C. Morgan.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 373-382, 2 fig, 3 tab, 15 ref.

Descriptors: *Erosion, *Soil erosion, *Splash erosion, Field tests, Bedfordshire, England, Sandy soil, Sandy loan, Calcareous clay, Rainfall.

The field splash cup proved to be a suitable method for measuring splash erosion in the field. Mean annual rates of splash detachment were determined at four sites in Bedfordshire, England: (1) sandy soil with no crop cover and slope of 9-11 degrees, (2) sandy loam with winter oats, wheat, and beans, and slope of 4 to 7 degrees, (3) calcareous clay with winter wheat and spring barley and slope of 6 to 10 degrees, and (4) calcareous clay overlain by gravelly drift with spring barley and slope of 7 to 10 degrees. Mean annual values were rainfall, 555 mm; rainfall energy, 1050 J/sq m. Annual rates of splash detachment varied from 30-45 g/cm on the bare sandy soils to 5-8 g/cm on the clay soils under cereals. Most detachment on the bare sandy soils occurred in summer during intense storms with rainfall energies over 100 J/sq m and rainfall totals above 10 mm. Detachment rates for 100-day periods and sandy soils were 15-50 g/cm in summer and 2-9 g/cm in winter; for 100-day periods and clay soils, 0.3-5 g/cm in summer and 7-10 g/cm in winter. Laboratory and field test results were comparable except when surface crusting, frost action, and plant cover interfered with splash erosion. (See also W86-04843) (Cassar-PTT)
W86-04880

INSTRUMENTATION FOR STUDIES OF THE EROSIVE POWER OF RAINFALL,
National Coll. of Agricultural Engineering, Silsoe (England).
For primary bibliographic entry see Field 7B.
W86-04881

SOIL EROSION UNDER SIMULATED RAINFALL IN THE FIELD AND LABORATORY: VARIABILITY OF EROSION UNDER CONTROLLED CONDITIONS,
Scarborough Coll., Westhill (Ontario). Dept. of Geography.
R. B. Bryan.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 391-403, 4 fig, 4 tab, 24 ref.

Descriptors: *Erosion, *Measuring instruments, *Rainfall simulators, Rainfall, Soil erosion, Simulated rainfall, Soil loss, Experimental design.

Rainfall simulators were compared in an effort to standardize experimental conditions and results. Most simulators fall short of producing type rainfall. The most serious problems are lack of intermittent rainfall conditions, insufficient terminal velocity of the raindrop, and lack of provision for random spatial, temporal, intensity, impact, and drop size variations characteristic of natural rainfall. The design differences among simulators leads to a problem in comparing results. On a series of 7 soils the Leuven simulator produced much greater soil losses (0.03-4.40 g/sq mm) than the Toronto simulator (0.03-0.59 g/sq mm). Likewise, test parameters and procedures (rainfall intensity and duration, slope, sample and site preparation) introduce many variables into experiments. Three Toronto soils were used to study the magnitude and sources of soil loss variability. Initial data suggest that variability reflects primarily the superimposition of the effects of two critical variables, raindrops and aggregates, both with wide size spectra. These problems can be minimized by sufficient replication. (See also W86-04843) (Cassar-PTT)
W86-04882

LABORATORY AND FIELD TESTING OF A PROGRAMMABLE PLOT-SIZED RAINFALL SIMULATOR,
Purdue Univ., Lafayette, IN. Agricultural Experiment Station.
W. H. Neibling, G. R. Foster, R. A. Natterman, J. D. Nowlin, and P. V. Holbert.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 405-414, 5 fig, 3 tab, 17 ref.

Descriptors: *Erosion, *Measuring instruments, *Rainfall simulators, Simulated rainfall, Soil loss, Field tests, Rainulator, Rainfall intensity, Nozzles, Runoff.

A programmable rainfall simulator for 4 x 11 m and longer field plots was tested and compared with a current rainulator. The new simulator uses an oscillating nozzle and is programmable for variable intensities in time and space. The nozzles of the programmable simulator are the same as those of the rainulator, but cycle times of a nozzle have been reduced from about 20 to 0.5 sec for a rainfall intensity of 64 mm/hour. Repeatable intensities are easier to obtain with the programmable simulator than with the rainulator, but intensity is slightly more uniform with the rainulator. Runoff and especially soil loss may be less with the programmable simulator than with the rainulator. However, the ease of assembly, short cycle times for minimal effects from intermittent rainfall bursts, and programmable intensities give the programmable simulator definite advantages for research in infiltration, overland flow, and erosion. (See also W86-04843) (Author's abstract)
W86-04883

OUTDOOR PORTABLE RAINFALL EROSION LABORATORY,
Agricultural Research Service, Morris, MN. North Central Soil Conservation Research Center.
For primary bibliographic entry see Field 7B.
W86-04884

SOME LABORATORY TECHNIQUES OF INVESTIGATING LAND EROSION,
Katholieke Univ. Leuven (Belgium). Lab. voor Experimentele Geomorfologie.
J. de Ploey.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 423-431, 3 fig, 28 ref.

Descriptors: *Erosion, *Soil mechanics, *Consistency indices, *Landslides, Soil erosion, Soil loss, Flumes, Plasticity index, Rill erosion, Soil properties, Rainfall, Rainstorms, Universal soil loss equation, Slopes.

Consistency indices, such as the plasticity index Ip and the proposed index C5-10, are useful in landslide and crustability risk assessments. Another predictive technique is flume experimentation. This is relatively inexpensive and is useful for studying heavy, short-term rainstorms on topsoils with limited internal drainage. Traditional objections to the short flume lengths are answered. The appearance of rill erosion in flumes is not surprising because they are usually tilted at the critical slope angle. The Universal Soil Loss Equation is applicable to short slope lengths; a nomograph gives the topographical factor LS for lengths down to 10 ft. The increase of LS values depends more on the growing steepness of the slope than on the increase of slope length. For most aggregated soils, erodibility is significantly negatively correlated to the quantity of water stable aggregates. (See also W86-04843) (Cassar-PTT)
W86-04885

INVESTIGATION OF SOURCE AREAS OF SEDIMENT AND SEDIMENT TRANSPORT BY OVERLAND FLOW ALONG ARID HILLSLOPES,
Hebrew Univ., Jerusalem (Israel). Inst. of Earth Sciences.
A. Yair, and H. Lavee.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 433-446, 8 fig, 1 tab, 42 ref.

Descriptors: *Erosion, *Sediment transport, *Slopes, Arid lands, Rainfall, Wildlife, Animals, Soil surfaces, Israel, Rainfall rate, Surface flow.

The study of hillslope erosion at the Sde Boqer, Israel, experimental site suggests that sediment delivery from arid slopes 60-70 m long is principally controlled by the combined effect of short-duration rain showers and activity of burrowing animals. Velocities at peak flow are below the threshold value needed to detach particles from the crusted soil due to very shallow overland flow and the rough, stony surface. However, the disaggregated soil produced by burrowing animals is readily transported at these flow velocities. As a result, no correlation between sediment yield and slope gradient and length is found. In most cases rainfall from the short showers does not reach the base of the slope. Under such conditions the proximity of the sediment source to the slope base is an important factor in slope sediment delivery. (See also W86-04843) (Cassar-PTT)
W86-04886

SPATIAL AND TEMPORAL VARIATIONS IN EROSION MEASUREMENTS,
Alberta Univ., Edmonton. Dept. of Geography.
For primary bibliographic entry see Field 7A.
W86-04887

RATE OF EROSION PROCESSES ON EXPERIMENTAL AREAS IN THE MARCHIAZZA BASIN (NORTHWESTERN ITALY),
Consiglio Nazionale delle Ricerche, Turin (Italy). Ist. di Ricerca per la Protezione Idrogeologica nel Bacino Padano.
For primary bibliographic entry see Field 4D.
W86-04888

ESTABLISHMENT OF EXPERIMENTAL PLOTS FOR STUDYING RUNOFF AND SOIL LOSS IN THE ROLLING LOESS REGIONS OF CHINA,
Yellow River Conservancy Commission, Zhengzhou (China). Inst. of Hydraulic Research.
M. Jinze.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 467-477, 5 fig, 3 tab, 2 ref.

Descriptors: *Erosion, *Slopes, *Loess, Soil erosion, Soil loss, China, Erosion control, Soil conservation, Conservation, Yellow River, Tuanshangou, Gully erosion.

Experimental plots covering entire slope areas bordered by natural divides and extending over the entire slope length were established at Tuanshangou in the loess plateau of the Yellow River, China. These were necessary in this type of soil because total annual erosion was less in smaller plots than in larger plots under the same conditions. This was due to the predominance of gully erosion and the increase of sediment concentration along the path of flow. Three methods to compute the quantity of sediment detention by conservation measures currently used in China are as follows: addition of sediment trapped by individual measures of soil and water conservation correlation method (average rainfall over the drainage area with runoff and sediment content), and comparison of the results obtained by using the different methods. (See also W86-04843) (Cassar-PTT)
W86-04889

PORTABLE RILL METER FOR FIELD MEASUREMENT OF SOIL LOSS,
Agricultural Research Service, Pullman, WA.
For primary bibliographic entry see Field 7B.
W86-04890

RELATIONSHIP BETWEEN THREE SCALES OF EROSION MEASUREMENT ON TWO SMALL BASINS IN SIERRA LEONE,
Sierra Leone Univ., Freetown. Dept. of Geography.
A. C. Millington.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 485-492, 3 fig, 6 tab, 4 ref.

Descriptors: *Erosion, *Soil erosion, Soil loss, Freetown Mountains, Sierra Leone, Sediment yield, Slopes, Macroscale studies, Mountain Torrent basin, Bambara Spring basin.

Erosion studies were conducted on three scales (macro-, meso, and micro-) in two dammed second-order basins in the Freetown Peninsula Mountains of Sierra Leone. Sediment was measured in basins or tanks for the macroscale study; in troughs for the mesoscale study; and with pin transects for the microscale study. Soil measurements for the pin measurements tended to be much higher in most cases than the trough measurements, particularly in cassava vs. rice plots. Mean sediment yield (t/sq kg/year) measured by the macroscale method was 2.00 for Mountain Torrent basin and 0.07 for Bambara Spring basin. Sediment yields predicted from the smaller scale measurements were much higher, 5.817 and 0.584 (t/sq km/year), respectively. Reasons for this are as follows: channel sediment production is low, leaf litter filters out downwashed sediment, temporal variations, rarity of lower slope concavity and related deposition, and operator error. (See also W86-04843) (Cassar-PTT)
W86-04891

EROSION AND SEDIMENT TRANSPORT MEASUREMENT IN A WEATHERED GRANITE MOUNTAIN AREA,
Kyoto Univ. (Japan). Dept. of Forestry.
A. Takei, S. Kobashi, and Y. Fukushima.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 493-502, 15 fig, 3 tab, 1 ref.

Descriptors: *Erosion, *Sediment transport, Mountains, Granite, Tanakami, Japan, Sediment yield, Forests, Rivers, Bed load, Soil loss, Soil erosion, Suspended sediment, Settling basins.

In the Tanakami region, a mountainous area underlain by weathered granite, erosion and sediment yield have been measured at several observational scales. First, the peg method, involving measurements of the height of pegs driven into the soil, was applied on three plots (70-115 sq m); measurements were made every month over 10 years. The results show that the annual rate of erosion from each plot is almost constant. Second, the sediment yield from a bare and a reforested plot (5 x 20 m) and from a small basin, (2.66 ha) have been measured for individual storm events using settling basins. The results show that the sediment yield can be estimated using the bed load formula of Meyer-Peter and Muller. Third, the sediment transport from a large basin (1.4 sq km) was measured using sand sampling apparatus which permits the collection of sediment samples at any desired position in the cross section of the river. The results show that particle size is important in influencing the separation between the bed load and the suspended load. (See also W86-04843) (Author's abstract)
W86-04892

FIELD MEASUREMENTS OF RATES OF BANK EROSION AND BANK MATERIAL STRENGTH,
Akademiya Nauk SSSR, Moscow. Soviet Geophysical Committee.
For primary bibliographic entry see Field 7B.
W86-04893

WIND AND WATER EROSION OF WASTE HEAPS AT CONCENTRATION PLANTS FOR POTASSIUM PRODUCTION,
Akademiya Nauk SSSR, Moscow. Soviet Geophysical Committee.
For primary bibliographic entry see Field 5B.
W86-04894

LAND EROSION, RESEARCH EQUIPMENT, FORECASTING METHODS AND PROSPECTS FOR THEIR IMPROVEMENT,
Gruzinskii Nauchno-Issledovatel'skii Inst. Gidrotekhniki i Melioratsii, Tiflis (USSR).
Ts. E. Mirtskhoulava.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 521-527, 1 tab, 9 ref.

Descriptors: *Erosion, *Soil erosion, *Model studies, Mathematical models, Soil properties, Cohesion, Scour.

A simplified model for predicting erosion processes was verified by data from field studies on an erosion plot. The model succesfully approximated the erosion process. A new method for measuring soil cohesion is based on a strong correlation between cohesion and the depth of local scour caused by the application of a jet of water to a saturated soil. The advantages of a systems approach to studies of soil stability and erosion is stressed. (See also W86-04843) (Cassar - PTT)
W86-04895

RECENT DEVELOPMENTS IN THE EXPLANATION AND PREDICTION OF EROSION AND SEDIMENT YIELD.
International Association of Hydrological Sciences.
Available from the IAHS, 2000 Florida Ave., NW,

Washington, DC. 20009. Price: $35.00. IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. Edited by D. E. Walling. 430 p.

Descriptors: *Erosion, *Sediment yield, *Sediment erosion, *Runoff, *Erosion rates, *Model studies, *Soil stability, Rivers, Drainage area, Basins, Suspended sediments, Reservoirs, Dams, Water quality, Symposium, Forests.

Material from a symposium on erosion and sediment yield, organized by the International Commission on Continental Erosion, is presented. Studies on erosion processes include the effects of soil characteristics, slope length, terracing and subsurface water exfiltration on erosion; variations in runoff and erosion under various methods of protection; and sediment production under various forest-site conditions. Recent studies on sediment yields and channel adjustments included work on gully hydrology, calculation of sediment yields from reservoir deposition volumes, and long term prediction of the extremes of river bed level fluctuations. Modelling studies involve mathematical simulation and prediction of erosion, sediment yield, sediment transport, and runoff. Also included are studies on sediment quality related to discharge, temporal variation in suspended sediment properties, particle size characteristics, and vertical distribution of sediment concentrations. (See W86-04897 thru W86-04936) (Halterman - PTT)
W86-04896

SEDIMENT PRODUCTION UNDER VARIOUS FOREST-SITE CONDITIONS,
Stephen F. Austin State Univ., Nacogdoches, TX. School of Forestry.
M. Chang, F. A. Roth, and E. V. Hunt.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 13-22, 2 fig, 2 tab, 11 ref.

Descriptors: *Sediments, *Sedimentation, *Sediment erosion, *Erosion, Sheet erosion, Soil erosion, Runoff, Soil management, Soil mechanics, Soil water, Coshocton runoff samplers, Forests, Texas, Storm water, Universal Soil Loss Equation.

Sediment loss was observed using Coshocton N-1 runoff samplers installed on 0.02 ha plot-watersheds under six forest-site conditions in Texas, during 1980-1981. The soil is a highly erodible Woodtell series of Hapludalfs, supporting a 40 year old forest dominated by loblolly and shortleaf pines. Sediment yields from 19 runoff producing storms over a 9 month period were 0.011, 0.017, 0.156, 0.265, 3.462, and 3.423 t/ha, respectively, for the undisturbed, thinned (50%), clearcut without site preparation, chopped, KG bladed, and clear cultivated watersheds. Beside storm energy, variation of sediment losses among the treatments was highly related to storm runoff, soil moisture content, cover conditions, and site disturbance. The observed C values of the Universal Soil Loss Equation (USLE) under the various treatments generally fell within the ranges proposed by other investigators. With continued observations and replications in other soils, the USLE can probably provide reasonable estimates of sediment loss in forest land. (See also W86-04896) (Author's abstract)
W86-04898

EFFECTS OF SLOPE LENGTH AND TERRACING ON RUNOFF AND EROSION ON A TROPICAL SOIL,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
For primary bibliographic entry see Field 2E.
W86-04899

IMPACTS OF SOIL CHARACTERISTICS ON SOIL ERODIBILITY,
Guelph Univ. (Ontario). School of Engineering.
R. Pall, W. T. Dickinson, D. Green, and R. McGirr.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 39-47, 3 fig, 1 tab, 19 ref.

Descriptors: *Soil stability, *Soil characteristics, *Erosion, *Runoff, *Erosion control, Runoff, Erosion rates, Sediment control, Sediment erosion, Soil water, Catchment areas, Ontario, Canada, Sediment transport.

Field observations from two small drainage basins in the temperate climate of Southern Ontario, Canada, have been explored in the light of laboratory experiments for the purpose of identifying key soil characteristics affecting soil erodibility. High soil erosion and transport rates during and immediately following spring thaw temperature and soil water conditions appeared to be linked to the presence of low soil density, high soil water content and resulting low shear strength values in the surface soils. Laboratory tests on agricultural soil samples from the area verified the vulnerability of the soils to such density and water content conditions. Although the existing data base is acknowledged to be sparse, it is hypothesized that further examination of surface soil shear characteristics may be extremely fruitful in clarifying erosion processes in not only spring thaw but also arid soil/water environments. (See also W86-04896) (Author's abstract)
W86-04900

VARIATIONS IN RUNOFF AND EROSION UNDER VARIOUS METHODS OF PROTECTION,
Lajos Kossuth Univ., Debrecen (Hungary). Inst. of Geography.
Z. Pinczes.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 49-57, 6 fig, 2 tab, 1 ref.

Descriptors: *Soil stability, *Erosion, *Runoff, *Erosion control, Erosion rates, Sediments, Sediment control, Agricultural engineering, Runoff hydrographs, Sediment, Vineyards, Stake-support cultivation.

Methods of decreasing the degree of soil erosion with simple protection measures were studied using experiments on seven 350 sq m vineyard plots under the stake-support cultivation system. Plot treatments included variation in direction of furrows with regard to slope, placement of ridges perpendicular to the slope, and application of individual plate-like depressions. There was little correlation between the precipitation amount and eroded soil and runoff in unprotected plots. Correlation gradually improved with the various methods of protection and are quite high with ridges constructed row by row. (See also W86-04896) (Halterman - PTT)
W86-04901

EROSION INITIATION,
Pretoria Univ. (South Africa). Dept. of Civil Engineering.
A. Rooseboom, and F. J. Mulke.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 59-66, 8 fig, 10 ref.

Descriptors: *Sediments, *Sedimentation, Sediment erosion, Erosion, Sedimentation rates, Hydrological aspects, Mathematical models, Mathematical analysis, Soil water, Soil sampling.

Field observations from two small drainage basins in the temperate climate of Southern Ontario, Canada, have been explored in the light of laboratory experiments for the purpose of identifying key soil characteristics affecting soil erodibility. High soil erosion and transport rates during and immediately following spring thaw temperature and soil water conditions appeared to be linked to the presence of low soil density, high soil water content and resulting low shear strength values in the surface soils. Laboratory tests on agricultural soil samples from the area verified the vulnerability of the soils to such density and water content conditions. Although the existing data base is acknowledged to be sparse, it is hypothesized that further examination of surface soil shear characteristics may be extremely fruitful in clarifying erosion processes in not only spring thaw but also arid soil/water environments. (See also W86-04896) (Author's abstract)
W86-04902

RESULTS OF RECENT RESEARCH ON EROSION PROCESSES IN HUNGARY,
P. Salamin.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 67-71, 17 ref.

Descriptors: *Erosion, *Accelerated erosion, *Erosion classification, *Beach erosion, *Soil erosion, Mass wasting, Rockslides, Weathering, Hungary, Environmental erosion, Agricultural erosion.

A new classification of forms and processes of erosion is presented, together with results of Hungarian research on precipitation characteristics, the effects of splash erosion and soil freezing, and the behavior of clays. Also reported are investigations regarding agriculture, environmental erosion, and education related to erosion-related topics. The new classification scheme is based on the following: static state or weathering; dynamic state, including the destructive process (rockfalls and flows), areal latent processes, areal open processes, linear erosion, depositional processes, particular erosion of shores, deforestation, overgrazing and mining activity; and great complex surface destruction. (See also W86-04896) (Halterman - PTT)
W86-04903

ROLE OF SUBSURFACE WATER EXFILTRATION IN SOIL EROSION PROCESSES,
Tsukuba Univ. (Japan). Inst. of Geoscience.
T. Tanaka.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 73-80, 8 fig, 17 ref.

Descriptors: *Erosion, *Hydrology, *Groundwater, *Storm seepage, Subsurface drainage, Groundwater movement, Subsurface water, Soil erosion, Soil management, Overland flow, Exfiltration, Subsurface Water Exfiltration Model.

Overland flow phenomena were studied in relation to erosion processes in a small forested drainage. The field evidence showed that the major portion of overland flow was produced by water flowing out onto the soil surface through decayed stumps and soil pipes. Outflow points were concentrated in small restricted areas on the valley floor where the hydraulic gradients of the subsurface water evidenced upward flow toward the ground surface. These phenomena were largely controlled by dynamic conditions of the flow system within the subsurface zone. The concept that erosion processes are largely controlled by overland flow due to subsurface water exfiltration is defined as the Subsurface Water Exfiltration Model (SWEEM). Using this model it would be possible to explain the development of the stepped profile observed in the study basin. (See also W86-04896) (Author's abstract)
W86-04904

DEVELOPMENT OF SHEET EROSION ON INTENSIVELY USED SOILS,

Akademiya Nauk SSSR, Moscow. Pochvennyi Inst.
P. S. Tregubov.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 81-87, 1 tab, 9 ref.

Descriptors: *Erosion, *Sheet runoff, *Land use, Agricultural aspects, Snowmelt, Snowmelt runoff, Runoff, Runoff hydrographs, Slope, USSR.

The processes of water erosion, their control by the type, length, steepness and utilization of the slope, and the influence of relief, soil cover and climatic factors are discussed. The depth of snowmelt runoff, sediment particle size distributions within the streams, sedimentation and soil losses in lowland and mountain terrain and the base levels of erosion are described for the main agricultural regions of the USSR. An analysis of the development of mechanical erosion on slopes is presented and the influence of soil erodibility and of the distribution of different crops on the various slope elements on the magnitude of soil loss is also described. The distribution of land and crops within the main natural zones of the USSR, according to their degree of erosion is shown. (See also W86-04896) (Author's abstract)
W86-04905

HYDROLOGICAL AND GEOMORPHOLOGICAL STUDIES OF DEBRIS SLIDES ON FORESTED HILLSLOPES IN JAPAN,
Tokyo Univ. of Agriculture and Technology (Japan). Dept. of Forestry.
Y. Tsukamoto, T. Ohta, and H. Noguchi.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 89-98, 5 fig, 5 tab, 8 ref. Project Nos. 402012 and 544010.

Descriptors: *Hydrology, *Hydrological aspects, *Erosion, *Forests, Landslides, Mass wasting, Japan, Forest hydrology, Forest management, Forest watersheds, Storm water, Slopes, O-order basins.

Debris slides are the predominant erosional process on forested hillslopes in Japan. The hillslopes in a basin are composed of slope units of three different types, i.e. convergent, divergent and plane types. More than 80% of debris slides occur on the convergent slopes, which collect and discharge storm water as well as weathered material most actively. The writers have called this spoon-shaped slope unit an O-order basin, which is the most important slope unit from the hydrological and geomorphological viewpoint. Field investigations in O-order basins indicate that pipes develop in shallow soil layers to discharge the converging subsurface storm water. Nearly 100% of the discharge from a trench profile in an O-order basin was through pipes. Discharge through the soil matrix was negligible. The pipeflow is presumed to play an important role in debris yield in a mountain basin during extremely heavy storms. (See also W86-04896) (Author's abstract)
W86-04906

EROSION AND SEDIMENT TRANPORT PROCESSES IN STEP-POOL TORRENTS,
Lincoln Coll. (New Zealand). Dept. of Agricultural Engineering.
J. G. Whittaker, and T. R. H. Davies.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 99-104, 2 fig, 1 tab, 11 ref.

Descriptors: *Erosion, *Sediments, *Sediment transport, *Streamflow, Flow, High flow, Turbulent flow, Sediment erosion, Sediment load, Sediment carrying capacity, Flow rates, Channel slopes, Slope degradation.

In upland regions, streams often exhibit a step-pool morphology where water cascades between relatively deep pools. The capacity of such streams to entrain adjacent slope material depends not only on water flow rate and channel slope, but also on the degree of infilling of the pools by sediment. This situation has been idealized, using a laboratory channel containing regularly spaced baffles. The results appear consistent with findings of studies of real torrents. The laboratory investigation has revealed that the erosive capacity of step-pool streams reaches a maximum (for a given flow rate) when the pools are almost full of sediment; that is, when sediment transport rates are high. This behavior is conducive to erosion of adjacent slopes and contrasts with that of lowland alluvial streams. Despite steady inputs, water and sediment outputs from the laboratory channel were often independently unsteady. Step-pool streams thus seem to display intrinsic unsteadiness, particularly of sediment movement. This parallels reports of coherent sediment 'waves' moving slowly through mountain torrents. Such behavior is consistent with recent findings on the thermodynamics of nonlinear systems. (See also W86-04986) (Author's abstract)
W86-04907

EFFECT OF SOIL CHARACTERISTICS ON EROSION AND NUTRIENT LOSS,
Agricultural Research Service, Morris, MN.
R. A. Young, and C. A. Onstad.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 105-113, 3 tab, 32 ref.

Descriptors: *Erosion, *Soil erosion, *Rill erosion, Soil classification, Soil aggregates, Soil mechanics, Soil organic matter, Soil physical properties, Soil porosity.

Soil properties which exert a significant influence on the type of erosion occurring, interrill or rill, were compared. Those characteristics most influential in determining a soil's susceptibility to interrill erosion are the degree of aggregation of the surface soil, the stability of soil aggregates to breakdown under raindrop impact, and the type and amount of clay in the soil. The characteristics influencing susceptibility to rill erosion are organic matter content, aggregate density, bulk density of the surface soil, and the dispersion ratio. Some factors affecting the transportability of detached particles were also examined along with their possible effects on nutrient enrichment of sediment. (See also W86-04986) (Author's abstract)
W86-04908

LONG TERM PREDICTION OF THE EXTREMES OF RIVER BED LEVEL FLUCTUATIONS,
Institute of Meteorology and Water Management, Warsaw (Poland).
For primary bibliographic entry see Field 2E.
W86-04909

SURFACE FLOW AND EROSIONAL PROCESSES IN SEMIARID MESCOSCALE CHANNELS AND DRAINAGE BASINS,
Scarborough Coll., Westhill (Ontario). Dept. of Geography.
R. B. Bryan, and I. A. Campbell.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 123-133, 3 fig, 2 tab, 14 ref.

Descriptors: *Erosion, *Sediment, *Runoff, *Surface flow, Surface runoff, Sedimentation, Erosion, rates, Channeling, Alberta, Canada, Dinosaur Badlands, Drainage patterns.

Detailed studies of surface flow and initiation of channels and drainage networks are facilitated in badlands where barren, rapidly eroded surfaces offer ideal sites for micro and mesoscale experiments. A study was carried out in the Dinosaur badlands of Alberta to establish the relationship between microscale processes and the hydrologic and sediment budgets for a typical mesoscale badland basin. The study shows a considerable range of responses in erosion rates and sediment and runoff yields at various scales. At the microscale, the response of desiccated shales depends on the detailed interaction of raindrop impact, particle detachment, surface sealing and subsurface flow, while indurated sandstones and pediments yield flow and sediment almost instantly, even under low rainfall. The water and sediment flows form a complex system and different response thresholds pose considerable problems for precise monitoring in mesoscale basins. (See also W86-04986) (Author's abstract)
W86-04910

GULLY HYDROLOGY AND RELATED SOIL PROPERTIES IN LESOTHO,
National Univ. of Lesotho, Roma.
For primary bibliographic entry see Field 2E.
W86-04911

EROSION AND RECOVERY OF SEDIMENT CONCENTRATION IN THE RIVER CHANNEL DOWNSTREAM FROM DANJIANKOU RESERVOIR,
Water Conservancy Hydroelectric Power Scientific Research Inst., Beijing (China).
H. Giwei, W. Yuchin, and X. Xilong.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 145-152, 4 tab, 3 ref.

Descriptors: *Erosion, *Scour, *Sediment transport, *Sediment concentration, China, Reservoirs, Rivers, Alluvial rivers, Hanjiang River, Danjiankou Reservoir.

The scouring of the downstream channel of an alluvial river by the clear water released from a reservoir is considered. The characteristics of the sediment transport capacity of the Hanjiang River downstream from Danjiankou Reservoir (China) and the phenomenon of recovery of sediment concentration by the scouring process are discussed. The author's theory of nonequilibrium transportation of nonuniform sediment is used to describe the recovery of sediment concentration along the river, including the variation of sediment transport capacity, the nature of sediment concentration recovery, and the mechanisms involved. A sediment concentration recovery calculation method is presented. (See also W86-04896) (Halterman - PTT)
W86-04912

PROPOSED METHOD FOR ACCURATELY CALCULATING SEDIMENT YIELDS FROM RESERVOIR DEPOSITION VOLUMES,
J. P. Jolly.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 153-161, 4 tab, 6 ref.

Descriptors: *Sediment yield, *Reservoir silting, *Prediction, Reservoirs, Hydrology, Sediment concentration, Sediment discharge, Catchment areas.

A means of developing a relation between sediment yield and the hydrological, geological and climatic characteristics of the upstream drainage basin, is presented. The method can be used worldwide to estimate sediment loads at potential future reservoir sites. The problems of sediment deposition in reservoirs are discussed, and an overview is presented of the magnitude and controls of major basin sediment yields. Data pertaining to sedimentation in many existing reservoirs were collected, then were synthesized into a form that can be used by engineers to produce more accurate estimates of sediment inflows. The accuracy and economics of

four methods of determining reservoir deposition rates were analysed. (See also W86-04896) (Halterman - PTT)
W86-04913

ESTIMATION OF EROSION AND SEDIMENT YIELD BY VOLUME MEASUREMENTS ON A LACUSTRINE RIVER DELTA,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
A. M. Lambert.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 171-176, 3 fig, 1 tab, 5 ref.

Descriptors: *Erosion, *Drainage area, *Sediment yield, Bathymetry, Prediction, Deltas, Floods, Hydrographs, Switzerland, Linth River, Glarus Alps, Drainage canals, Lacustrine River Delta.

In 1811 the River Linth, which drains 600 sq km of the Glarus Alps (Switzerland), was diverted by the construction of a canal into a lake (the Walensee), where it has built a rapidly growing delta cone. The increase in deposited sediment volume was measured by different bathymetric surveys (1849, 1860, 1911, 1931, 1979) and gives a valuable estimate of erosion in the drainage area. Whereas the wire sounding method was used until 1931, the 1979 survey was performed by a largely automated survey system based on digital terrain models established by high resolution echo-sounding combined with laser-guided and computerized polar positioning. Since the last survey (1983) the increase in the delta volume was about 6,500,000 cu m in 48 years, thus implying an average annual lowering of the drainage area by 0.23 mm. Compared with the earlier survey period (1911-1931: 0.17 mm/year), this indicates increased erosion, probably as a result of unusual floods. Based on these data, a simple model is used to predict erosion in the drainage area of the River Linth. (See also W86-04896) (Author's abstract)
W86-04914

ANALYSIS OF SEDIMENT YIELD AND TRANSPORT DATA FOR EROSION CONTROL WORKS,
Public Works Research Inst., Tsukuba (Japan).
For primary bibliographic entry see Field 4D.
W86-04915

EROSIONAL PROCESSES AND SEDIMENT YIELD IN THE UPPER OLDMAN RIVER BASIN, ALBERTA, CANADA,
Northwest Hdruulic Consultants Ltd., Edmonton (Alberta).
For primary bibliographic entry see Field 4D.
W86-04916

EROSION AND SEDIMENT YIELD IN THE KRISHNA RIVER BASIN, INDIA,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
V. Subramanian.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 193-198, 3 fig, 1 tab, 11 ref.

Descriptors: *Erosion, *Sediment yield, *Erosion rates, *Catchment areas, Sediment load, Runoff, Hydrology, Dams, India, Krishna River, Bay of Bengal.

Discharge and sediment data obtained from the Central Water Commission for the Krishna River basin in India are analyzed and certain basin erosion processes are highlighted. The annual sediment load of the Krishna River has been shown to vary regularly with annual runoff over a 6 year period (1971-1976). Similar relationships have also been observed for individual regions of the basin. The quantity of sediment discharged into the Bay of Bengal does not truly reflect the actual sediment load because of the influence of upstream dams. Rates of erosion calculated for various sub-basins indicate that smaller basins erode more rapidly than larger basins. Again, annual variations exist but the erosion rate/basin area relationship is similar every year. While at the river mouth the sediments are texturally uniform, in the upstream region the relative proportions of clay silt and sand vary erratically. The apparent homogeneity at the river mouth is perhaps due to selective sedimentation at the dam sites. (See also W86-04896) (Author's abstract)
W86-04917

MORPHOLOGICAL INVESTIGATIONS ON THE LOWER SALZACH RIVER DOWNSTREAM OF SALZBURG,
Bayerisches Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.).
F. H. Weiss, and J. Mangelsdorf.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 209-218, 5 fig, 6 ref.

Descriptors: *Rivers, *River beds, *Erosion, *River morphology, Bed load, Stream erosion, Alpine regions, Hydrography, Sediments, Salzach River, Hydroelectric plants, Gages, Water level.

A case study involving a morphological investigation on the River Salzbach in the Central Alps is presented. The study was prompted by the proposed building of four hydroelectric power plants, and attempted to predict the resultant changes in river morphology. A geographical and historical review is presented, along with a study of bed erosion and bed load transport by three methods: firstly, by analysis of the hydrographs of annual mean water level from several gages for which about 150 years of staff gage operations exist; secondly, by longitudinal surveys carried out at low water under comparable discharges, and finally, by cross seection surveys (thalweg or mean bed level of several years). The causes of bed erosion, namely river training, removal of bed material and the installation of upstream supporting weirs, are discussed. (See also W86-04896) (Author's abstract)
W86-04918

MATHEMATICAL SIMULATION OF EROSION ON GRADED TERRACES,
Old Dominion Univ., Norfolk, VA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4D.
W86-04919

APPLICABILITY OF THE UNIVERSAL SOIL LOSS EQUATION IN MOUNTAIN WATERSHEDS IN SEMIARID AND HUMID REGIONS,
Centre for Water Resources, Madras (India).
For primary bibliographic entry see Field 4D.
W86-04920

DEVELOPMENT OF DRAINAGE NETWORKS,
Universidad Simon Bolivar, Caracas (Venezuela). Graduate Program in Hydrology and Water Resources.
For primary bibliographic entry see Field 4D.
W86-04921

SEDIMENT MODELLING AND DATA SOURCES: A COMPROMISE IN ASSESSMENT,
University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering.
G. Fleming, and A. al Kadhimi.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 251-259, 5 fig, 18 ref.

Descriptors: *Model studies, *Mathematical models, *Sediment erosion, Erosion, Sediment yield, Drainage area, Hydrology, Sediment transport, Catchment areas.

The major problem in modelling sediment erosion, transport and deposition for the assessment of sediment yield is the shortage of reliable data with which to develop and test the desired model. This data source limitation restricts the model developer in selecting the appropriate theory to describe a model structure that accounts for the correct interaction between processes contributing to the sediment yield of drainage basins. It also restricts the application of developed models in their practical design application. The development of sediment modelling is reviewed, and a discussion is presented of the compromise that must be made before models can be usefully employed in sediment yield assessment for design of water resource systems. It is concluded that the use of total river basin sediment-hydrology models can play an important part in bridging the gap between limited data sources and understanding of the relation between factors affecting drainage basin response. (See also W86-04896) (Author's abstract)
W86-04922

SOIL EROSION AND AGRICULTURE IN THE WORLD: AN ASSESSMENT AND HYDROLOGICAL IMPLICATIONS,
Moscow State Univ. (USSR). Dept. of Hydrology.
For primary bibliographic entry see Field 4D.
W86-04923

ESTIMATION OF EXTREME SEDIMENT TRANSPORT FROM TORRENTIAL DRAINAGE BASINS IN THE EAST ALPS,
Torrent and Avalanche Control Research Inst., Vienna (Austria).
For primary bibliographic entry see Field 4D.
W86-04924

DEVELOPMENT OF A PROCEDURE TO ESTIMATE RUNOFF AND SEDIMENT TRANSPORT IN EPHEMERAL STREAMS,
Agricultural Research Service, Tucson, AZ. Southwest Watershed Research Center.
L. J. Lane.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 275-282, 2 fig, 33 ref.

Descriptors: *Model studies, *Watersheds, *Sediment transport, Semiarid lands, Small watersheds, Hydrologic models, Sediment yields, Alluvial channels, Flood frequency, Runoff, Ephemeral streams.

A hydrological model for application on small semiarid watersheds is developed. The model incorporates simplified routing schemes to include the influence of transmission losses on runoff. A sediment transport model, by sediment size fractions, is developed to compute transport capacity and sediment yield in noncohesive, alluvial channels. Based on available information published on soils and topographic maps and on channel and bed sediment characteristics, the procedure is used to estimate runoff rates and amounts together with sediment yields from semiarid watersheds. Example applications include flood frequency analysis and sediment yield. The procedure requires a minimum of observed data for calibration and is designed for practical applications. (W86-04896) (Author's abstract)
W86-04925

HYDRODYNAMIC MODEL OF SEDIMENT TRANSPORT IN RILL FLOWS,
Mississippi Univ., University. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4D.
W86-04926

PREDICTION OF SEDIMENT YIELD FOR MOUNTAINOUS BASINS IN COLUMBIA, SOUTH AMERICA,
Rijkswaterstaat, Arnhem (Netherlands). Directorate for Water Management and Hydraulic Research.
For primary bibliographic entry see Field 4D.
W86-04927

SEDIMENT AVAILABILITY AND THE PREDICTION OF STORM-PERIOD SEDIMENT YIELDS,
Exeter Univ. (England).
For primary bibliographic entry see Field 4D.
W86-04928

SEDIMENT QUALITY RELATED TO DISCHARGE IN A MINERALIZED REGION OF WALES,
University Coll. of Wales, Aberystwyth. Dept. of Geography.
For primary bibliographic entry see Field 5B.
W86-04929

TIMESCALES OF DENUDATION: THE LAKE-DRAINAGE BASIN APPROACH,
Coventry (Lanchester) Polytechnic (England). Dept. of Geography.
For primary bibliographic entry see Field 4D.
W86-04930

IDENTIFICATION AND QUANTIFICATION OF SEDIMENT SOURCES USING 137-CS,
Newcastle Univ. (Australia). Dept. of Geography.
R. J. Loughran, B. L. Campbell, and G. L. Elliott.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 361-369, 1 fig, 3 tab, 17 ref.

Descriptors: *Cesium, *Radioactive tracers, *Cultivated lands, *Sediment, *Heavy metals, Erosion, Soil erosion, Australia, Drainage area, Hunter Valley, New South Wales.

The environmental radioactive tracer 137-Cs (a fallout product of atmospheric nuclear weapons' testing) was used to indicate sources of soil erosion in a small drainage basin the Hunter Valley, New South Wales, Australia. At sites undergoing little or no erosion, the 137-Cs had accumulated in the upper soil profile, and eroded soils contained relatively less 137-Cs. Cultivated soils were identified as the chief sediment source, since they contained, on average, only one-third the 137-Cs of soils under grass cover. While the calibration of the 137-Cs technique to quantify soil loss remained uncertain, 137-Cs concentrations did appear to be related to some degree to a soil aggregate stability index. (See also W86-04896) (Author's abstract)
W86-04931

INFLUENCE OF SEASON, SOURCE AND DISTANCE ON PHYSICAL AND CHEMICAL PROPERTIES OF SUSPENDED SEDIMENT,
National Water Research Inst., Winnipeg (Manitoba).
For primary bibliographic entry see Field 5B.
W86-04932

USE OF LAMINATED LAKE SEDIMENTS IN THE ESTIMATION AND CALIBRATION OF EROSION RATES,
Plymouth Polytechnic (England). Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2H.
W86-04933

PARTICLE SIZE CHARACTERISTICS OF FLUVIAL SUSPENDED SEDIMENT,
Exeter Univ. (England).
For primary bibliographic entry see Field 5B.
W86-04934

TEMPORAL VARIATION OF SUSPENDED SEDIMENT PROPERTIES,
Exeter Univ. (England).
For primary bibliographic entry see Field 5B.
W86-04935

ANALYSIS OF THE VERTICAL DISTRIBUTION OF HIGH SEDIMENT CONCENTRATIONS IN THE YELLOW RIVER AND STUDIES OF METHODS OF OBSERVATION,
Yellow River Conservancy Commission, Zhengzhou (China).
Z. Boliang, and N. Zhan.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 421-430, 7 fig, 2 tab, 4 ref.

Descriptors: *Suspended sediments, *Erosion, *Rivers, *Sediment concentration, Vertical distribution, Yellow River, China, Soil types, Sediment, Mathematical analysis.

Based on analyses of field data, it is demonstrated that the distribution of sediment at high concentrations in the Yellow River (China) is uniform. This is primarily due to three cause; firstly the effect of the initial conditions of sediment yield in the basin, secondly, the influence of the ultimate tangential stress of the fluid and, thirdly, the structure of the sediment mass. It has been found that theoretical formulae for determining the vertical distribution of sediment concentration, derived for low silt contents, are not applicable to conditions of hyperconcentration. Requirements for the methods and instruments used in measuring hyperconcentrations of sediment should be different from those for the measurement of low sediment content. (See also W86-04896) (Author's abstract)
W86-04936

SEDIMENT DYNAMICS IN A PARTIALLY CULTIVATED CATCHMENT IN NEW SOUTH WALES, AUSTRALIA,
Newcastle Univ. (Australia). Dept. of Geography.
R. J. Loughran, B. L. Campbell, and G. L. Elliott.
Journal of Hydrology, Vol. 83, No. 3/4, p 285-297, March 1986. 5 tab, 3 fig, 19 ref.

Descriptors: *Australia, *Runoff, *Sediment, *Sediments transport, *Catchment basins, New South Wales, Maluna Creek, Cesium, Environmental tracers, Hydrographs, Runoff plots, Surface runoff, Agricultural runoff, Cropland, Erosion, Forests, Grazing.

The relationships between the hydrology of runoff episodes and sediment transport are examined in the partially cultivated drainage basin of Maluna creek, in the Hunter River Valley, New South Wales, Australia, and interpreted by the use of runoff plot data and the environmental tracer cesium-137 over a three year period. The sediment output of 49.8 t/sq km/year was dominated by three runoff events, which together accounted for 79% of the total, though occupying only 0.6% of the study period time. These three events represented 10% of all episodes and accounted for 43% of the total runoff measured. In Maluna Creek, sediment concentrations usually reached a peak on the falling stage of the hydrograph, and mean concentration per event was positively related to discharge peakedness index, a measure of runoff intensity. Data from five erosion plots and water sampling within the catchment revealed cultivated vineyard soils as the major sediment source, compared with eucalypt forest and grassland, which made up 60 and 30% of the basin area, respectively. Cesium-137 concentration on stream-borne sediment delivered to the basin outlet was used to quantify sediment source. It was estimated that at least 93% of the sediment output was derived from vineyards, and the remaining 7% from forests and grazing land. (Peters-PTT)
W86-05114

MIGRATION PATTERNS OF AN ASYMMETRIC MEANDERING RIVER: THE ROUGE RIVER, QUEBEC,
National Hydrology Research Inst., Hull (Quebec).
For primary bibliographic entry see Field 2E.
W86-05219

WATER DISCHARGE AND SUSPENDED SEDIMENT CONCENTRATIONS IN THE AMAZON RIVER: 1982-1984,
Washington Univ., Seattle. School of Oceanography.
For primary bibliographic entry see Field 2E.
W86-05222

KINETICS OF MICROBIAL MANGANESE OXIDATION AND TRACE METAL BINDING IN SEDIMENTS: RESULTS FROM AN IN SITU DIALYSIS TECHNIQUE,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 2H.
W86-05278

DISSOLUTION KINETICS OF CHRYSOTILE AT PH 7 TO 10,
California Inst. of Tech., Pasadena. Dept. of Environmental Health Engineering.
For primary bibliographic entry see Field 2K.
W86-05290

MORPHOLOGIC EFFECTS OF CHANNELIZATION: THE CASE OF THE NEEBING-MCINTYRE FLOODWAY, THUNDER BAY, ONTARIO, CANADA,
Lakehead Univ., Thunder Bay (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 8B.
W86-05408

CHANNEL ADJUSTMENTS TO THE REMOVAL OF LOG STEPS: AN EXPERIMENT IN A MOUNTAIN STREAM,
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ. Forestry Sciences Lab.
For primary bibliographic entry see Field 4D.
W86-05409

2K. Chemical Processes

RADIOACTIVITY OF SPAS ON THE GREEK ISLAND IKARIA AND INFLUENCING FACTORS,
Democritus Nuclear Research Center, Athens (Greece).
S. Danali, G. Margomenou, and K. Veldeki.
Health Physics, Vol. 50, No. 4, p 509-513, April 1986. 3 tab, 1 fig, 18 ref.

Descriptors: *Radioactive springs, *Greece, Geological composition, Temperature effects, Spectroscopy, Radioisotopes.

A qualitative and quantitative determination by gamma spectroscopy analysis of all the natural radioisotopes which exist in the waters of the municipal thermometallic radioactive springs (spas) of the Greek island Ikaria was made. The spas of Ikaria show high concentrations of 222Rn, especially Apollo and Asclepius, which can be considered as among the most radioactive spas in the world. The other spas are Spelaion and Lefkada. Besides the high concentration of 222Rn, the spas of Ikaria, especially the high temperature ones, show high concentrations of 226Ra as well as 232Th. High concentrations of 40K also have been found in these spas. The spas with high concentrations of 222Rn show lower concentrations of 226Ra and vice versa. This may be due, mainly, to the difference in the temperature of these spa waters. The concentrations of radioisotopes in the water of the spas vary with the season and also with time. The number of the examined samples is not sufficient for a clear conclusion to be drawn. (Peters-PTT)
W86-04691

GAS CHROMATOGRAPHIC EVALUATION OF THE ORGANIC COMPONENTS PRESENT IN THE ATMOSPHERE AT TRACE LEVELS WITH THE AID OF CARBOPACK B FOR PRE-CONCENTRATION OF THE SAMPLE,
Consiglio Nazionale delle Ricerche, Rome (Italy). Ist. Inquinamento Atmosferico.
For primary bibliographic entry see Field 5A.
W86-04710

SINGLET OXYGEN IN SURFACE WATERS. 3. PHOTOCHEMICAL FORMATION AND STEADY-STATE CONCENTRATIONS IN VARIOUS TYPES OF WATERS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
W. R. Haag, and J. Holgne.
Environmental Science and Technology ESTHAG, Vol. 20, No. 4, p 341-348, April 1986. 8 fig, 3 tab, 26 ref.

Descriptors: *Singlet oxygen, *Surface waters, *Photolysis, *Dissolved organic carbon, *Molecular structure, *Water pollution, Switzerland, Furfuryl alcohol, Light, Lakes, Rivers, Wastewater, Color, Gel permeation chromatography.

For prediction of the rate with which organic compounds are oxidized and photoproducts formed in the aquatic environment by the singlet molecular oxygen singlet oxygen route, the steady-state concentrations of singlet oxygen in various waters were determined using furfuryl alcohol as a trapping agent. Under noon, summer sunlight (Switzerland) in lake, river, and wastewaters, surface concentrations were (0.3-3) x 10 to the minus 14th power mol singlet oxygen per mg of dissolved organic carbon/liter. The more highly colored waters actually tend to produce less singlet oxygen for a given amount of adsorbed light. Separation of natural aquatic organic compounds by gel permeation chromatography resulted in fractions showing little correlation between singlet oxygen production efficiency and molecular weight, indicating that large macromolecular structures are not a prerequisite for the sensitization of singlet oxygen formation. Application of the specific 102 concentration data to the estimation of lifetimes of environmental pollutants yields half-lives as short as several hours only for a few especially reactive types of compounds but orders of magnitude longer for most of the compounds expected to be found in the aquatic environment. (Author's abstract-PTT)
W86-04720

FLUORESCENCE CORRECTION FOR MEASUREMENTS OF ENZYME ACTIVITY IN NATURAL WATERS USING METHYLUMBELLIFERYL-SUBSTRATES,
Warsaw Univ. (Poland). Dept. of Environmental Microbiology.
R. J. Chrost, and H. J. Krambeck.
Archiv fuer Hydrobiologie AHYBAY, Vol. 106, No. 1, p 79-90, 1986. 4 fig, 4 tab, 16 ref.

Descriptors: *Fluorescence, *Enzyme activity, *Natural waters, *Methylumbelliferone, Enzymatic hydrolysis, Hydrogen ion concentration, Aquatic habitats, Mathematical analysis, Lakes, Water samples.

Substrates linked to a highly fluorescent compound, 4-metylumbelliferone (MUF), provide a very sensitive system for detecting and quantifying enzyme activity in aquatic environments. Fluorescence of MUF liberated after enzymatic hydrolysis of MUF-substrates was dependent on the concentration of released MUF, affected by pH of the sample. At a constant pH, fluorescence of MUF was proportional to its concentration between 1 and 150 nM. A more complex relationship between MUF-fluorescence and various pHs occurred, approaching asymptotes at low (pH < 3) and high (pH > 10) pH values, with a sigmoid pattern between pHs 2 and 13. Maximum MUF-fluorescence occurred at pH=10 and higher alkalinity did not increase the fluorescence. Rapid decreases in MUF-fluorescence between pH 9.0 and 7.0 occurred at all investigated MUF-concentrations. Enzyme activity determination in aquatic habitats should be assayed at the natural pH of the water sample. The most rapid decrease of MUF-fluorescence with increasingly acidity was observed within this pH range. MUF-fluorescence at pH=6.5 was only 15.3% of the fluorescence measured at pH=9.5. This pH-MUF-fluorescence relationship is critical when calculating and comparing enzyme activities measured at different pHs of samples from aquatic environments, and therefore a measured fluorescence must be corrected when calculating real enzyme activity values. The simple correction method when calculating enzyme activity, measured using MUF-substrates at different pH values was determined. Using mathematical formulae and sets of constants, the calculation of MUF-concentration (liberated after enzymatic hydrolysis) from measured MUF-fluorescence at various pHs of water samples was simple. The proposed method was applied for the calculation of exoenzymatic activity (phosphatase, Phosphodiesterase, beta-glucosidase, beta-galatosidase, protease) of water samples from different lakes of various pHs. (Lantz-PTT)
W86-05087

GEOCHEMISTRY AND DEPOSITION OF (7)BE IN RIVER-ESTUARINE AND COASTAL WATERS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
C. R. Olsen, I. L. Larsen, P. D. Lowry, and N. H. Cutshall.
Journal of Geophysical Research, Vol. 91, No. C1, p 896-908, January 15, 1986. 4 tab, 5 fig, 43 ref.

Descriptors: *Coastal waters, *Rivers, *Geochemistry, *Estuaries, *Beryllium, James estuary, Virginia, Norfolk, Tennessee, Oak Ridge, Salinity, Particulate matter, Carbon, Silicon, Aluminum, Potassium, Iron, Sediment, Chemical properties, Suspended sediments, Deposition.

The atmospheric flux of cosmogenic (7)Be (53.3-day half-life) and the mode of (7)Be deposition in river-estuarine and coastal environments have been examined. (7)Be measurements for water, suspended matter, and sediment samples collected in several river, estuarine, and coastal systems during 1981 to 1984 are reported. The atmospheric flux of (7)Be commonly supports inventories ranging from 1.0 to 2.0 pCi/sq cm (1 pCi=0.037 Bq). Beryllium 7 concentrations in water phase samples, collected across salinity gradients in several estuaries along the eastern coastline of the United States, range from 0.03 to 0.53 pCi/L and primarily reflect variations in (7)Be supply and sorption kinetics. The major process controlling the concentration of (7)Be on estuarine suspended particles appears to be the length of time that these particles remain in the water column. Field particle-to-water distribution coefficients for (7)Be have a median value of about 4 times 10 to the fourth power but range over an order of magnitude reflecting short-term variations in (7)Be input, particle dynamics, and particulate iron content rather than equilibrium sorption-desorption responses to change in water salinity or particle type. Residence times of (7)Be in the water column range from a few days in estuarine areas of rapid fine-particle deposition, to several weeks in high-energy environments where pronounced sediment resuspension reintroduces deposited (7)Be back into the water column. Inventories of (7)Be in sediments range from nondetectable to 3.3 pCi/sq cm, with the highest inventories in areas where fine particles are accumulating rapidly. Such sites are also major repositories for other particle-reactive substances. A (7)Be budget for the James estuary (Norfolk, VA) indicates that less than 5% of the expected (7)Be input is in the water column and that the short-term estuarine trapping efficiency for atmospherically derived (7)Be is somewhere between 50 and 100%. (Peters-PTT)
W86-05095

SOURCES AND SINKS OF IONS IN A SOFT WATER, ACIDIC LAKE IN FLORIDA,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
For primary bibliographic entry see Field 5B.
W86-05217

USE OF STREAM CHEMISTRY TO ESTIMATE HYDROLOGIC PARAMETERS,
Risk Science International, Washington, DC.
M. J. Brown.
Water Resources Research WRERAO, Vol. 22, No. 5, p 805-811, May 1986. 6 fig, 6 tab, 12 ref.

Descriptors: *Stream chemistry, *Path of pollutants, *Hydrologic properties, Runoff, Chemical properties, Chemical analysis, Minerals, Ions, Mathematical models, Nitrates, Nitrites, Streamflow, Groundwater, Phytoplankton.

The influence of direct and indirect runoff on the concentrations of chemical constituents in streams may be exploited as an aid to model calibration. In the Housatonic basin, data on streamflow and mineral ion concentrations conform well to a two-segment log-linear model. The fitted relationship between streamflow and mineral ion concentration depends primarily on the site, rather than on the mineral. Parameters of this fit yield estimates of hydrologic model parameters. Nonconservation constituents such as nitrate and nitrite exhibit varied patterns. At sites affected by large point source inputs, concentration decreases with flow. A simple model of load and streamflow produces estimates of the concentrations in indirect and direct runoff. The estimated concentrations in indirect runoff agree well with typical measured values of concentration in groundwater. At sites not affected by point sources, the (NO3-NO2) concentrations are lower, do not correlate with streamflow, and exhibit seasonal cycles. The cycles are due to such factors as uptake by phytoplankton. (Lantz-PTT)
W86-05227

CHEMICAL REACTIONS WITHIN ROOT ZONE OF ARID ZONE SOILS,
California Univ., Davis. Water Science and Engineering Section.
For primary bibliographic entry see Field 5B.
W86-05233

DISSOLUTION KINETICS OF CHRYSOTILE AT PH 7 TO 10,
California Inst. of Tech., Pasadena. Dept. of Environmental Health Engineering.
R. C. Bales, and J. 1J. Morgan.
Geochimica et Cosmochimica Acta, Vol. 49, No. 11, p 2281-2288, November 1985. 7 fig, 36 ref.

Descriptors: *Fate of pollutants, *Chrysotile, *Kinetics, Minerals, Hydrogen ion concentration, Magnesium hydroxide, Chemical reactions, Dissolution, Adsorption, Surface charge Inorganic compounds.

The rate of chrysotile dissolution over five days was studied in constant pH batch concentrations at 25 C. After the first day, release of magnesium occurred at a constant rate and exhibited a fractional dependence on pH. Interpreted in terms of a site binding model for adsorption of protons on the surface, this fractional dependence implies that the rate is limited by a chemical reaction involving less than one adsorbed proton per magnesium released into solution. The actual magnitude of the rate at pH 8 supports this interpretation. Three related processes were followed dissolution, adsorption and surface charge development. Inorganic materials such as chlorine, bicarbonate, sulfate, and nitrate ions and the organic substances catechol and oxalate affected the rate of magnesium release only during the initial 12 to 24 hours of each experiment. Silica release was linear from the outset of each experiment, but showed no definite pH dependence. The results suggest that magnesium hydroxide is more easily dissolved than minerals such as aluminum oxide, and that attack by water and hydrogen are both important in chrysotile dissolution. (Master-PTT).)
W86-05290

HELIUM ACCUMULATION IN GROUNDWATER. II: A MODEL FOR THE ACCUMULA-

TION OF THE CRUSTAL 4HE DEGASSING FLUX,
Australian National Univ., Canberra. Research School of Earth Sciences.
For primary bibliographic entry see Field 2F.
W86-05291

REGIONAL PH-ALKALINITY RELATIONSHIP,
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
M. J. Small, and M. C. Sutton.
Water Research, Vol. 20, No. 3, p 335-343, March 1986. 5 fig, 4 tab, 24 ref.

Descriptors: *Hydrogen ion concentration, *Alkalinity, *Models, Acidic streams, *Acid rain, Mathematical studies, Acidity, Mathematical models, Mathematical equations, Carbon dioxide, Regional analysis, Fate of pollution.

An explicit equation relating the pH and alkalinity of natural waters is derived as an inverse hyperbolic sine function. For the range of pH generally encountered in lake and stream acidification studies, the parameters of the equation are related to the dissolved CO2 saturation relative to atmospheric CO2 and the concentration of weak acid anions, though the relationship is approximate. The functional form allows for statistical parameter estimation given a regional or temporal pH-alkalinity data-set. The relationship simplifies pH estimation in regional aquatic acidification models where alkalinity is computed as the master variable. (Author's abstract)
W86-05338

COMPARISON OF METHODS FOR ESTIMATING SULFATE EXPORT FROM A FORESTED WATERSHED,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 5B.
W86-05389

ONE-DIMENSIONAL MODEL OF CHEMICAL DIFFUSION AND SORPTION IN SATURATED SOIL AND AQUATIC SYSTEMS,
Morrison-Knudsen Engineers, Inc., Denver, CO.
For primary bibliographic entry see Field 5B.
W86-05390

USE OF RAIN AND DRY DEPOSITION COMPOSITIONS FOR INTERPRETING GROUNDWATER CHEMISTRY,
Arkansas Univ., Fayetteville. Dept. of Geology.
G. H. Wagner, and K. F. Steele.
Groundwater, Vo. 23, No. 5, p 611-616, September-October 1985. 6 fig, 2 tab, 13 ref.

Descriptors: *Groundwater, *Chemical properties, *Rain composition, Evapotranspiration, Ion exchange, Spring water, Arkansas, Chlorine, Sodium, Potassium, Calcium carbonate, Ammonium, Magnesium, Calcium.

Waters from 91 springs in a 130 X 140 km area of west-central Arkansas were analyzed for all the major ions. The yearly flux of these ions in the rain and pure-water extract of the dry deposition 180 km north of this area was measured and assumed to represent the composition of the recharge to the groundwater feeding the springs. Cation/Cl(-) flux ratios were used as a norm for the concentration of ions in the spring waters by evapotranspiration. Ratios above the norm were interpreted as ion exchange or rock dissolution into groundwaters. Ratios below the norm were interpreted as ion adsprtion or, for Ca(+), CaCO3 precipitation processes. Na(+) and Mg(2+) are invariably above the norm. K(+), NH4(+) and H(+) are invariably below the norm; whereas Ca(2+) values are about equally divided between above and below the norm. Equivalents of cations above the norm and below the norm were compared for a number of springs to determine the main groundwater processes for each spring. The Na(+)/Cl(-) and K(+)/Cl(-) norms for the rain water form near-perfect minimum and maximum envelopes, respectively, of the Na(+) vs Cl(-) plots of the spring water compositions. This is due to the adsorption affinities of the soil for Na(+) being low, and for K(+) being high. (Author's abstract)
W86-05394

ROLE OF SPECIATION IN MERCURY METHYLATION IN SEDIMENTS AND WATER,
Leicester Polytechnic (England). School of Chemistry.
For primary bibliographic entry see Field 5B.
W86-05395

2L. Estuaries

LABORATORY MODELING OF A COASTAL UPWELLING,
University of Southern California, Los Angeles. Dept. of Mechanical Engineering.
S. Narimousa, and T. Maxworthy.
EOS, Transactions, American Geophysical Union, Vol. 67, No. 1, p 2-3, January 17, 1986. 4 fig, 9 ref.

Descriptors: *Standing waves, *Upwelling, *Ocean circulation, *Hydraulic models, Topographical features, Satellite technology, United States, Peru, Coasts.

Coastal upwelling was modeled in a rotating cylindrical tank (90 cm diameter, 22 cm depth), which has a conical bottom to simulate the geometry of the coastal shelf. In some experiments, the coastline and the conical bottom were free of any perturbations, whereas in others a cross shelf, a radial ridge, and/or a coastline perturbation (cape) were introduced into the tank to study their effects on the simulated upwelling circulations. The presence of a topographical feature on the conical bottom had a dramatic effect on the upwelled front. The first sign of the upwelled water at the surface was always a high-speed jetlike plume at the ridge. When a coastline perturbation or cape, but no bottom ridge, was employed, a high-speed jet was generated downstream of the cape with only one significant downstream standing wave, in contrast to the previous case in which there were a series of large meandering standing waves. Applications of the present results to upwelling events off the coast of the United States and Peru were in reasonably good agreement with the values measured from a satellite infrared image or reported from field observations. (Rochester-PTT)
W86-04980

GEOCHEMISTRY AND DEPOSITION OF (7)BE IN RIVER-ESTUARINE AND COASTAL WATERS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 2K.
W86-05095

SALINITY INTRUSION IN THE EASTMAIN RIVER ESTUARY FOLLOWING A MAJOR REDUCTION OF FRESHWATER INPUT,
McGill Univ., Montreal (Quebec). Inst. of Oceanography.
S. Lepage, and R. G. Ingram.
Journal of Geophysical Research, Vol. 91, No. C1, p 909-915, January 15, 1986. 2 tab, 8 fig, 19 ref.

Descriptors: *Eastmain River, *Saline water intrusion, *Estuaries, LaGrand River, Velocity, James Bay, Canada, Mathematical models, Diversion.

On July 19, 1980, 80% of the runoff of Eastmain River (it originates in the Canadian Shield and empties into the eastern portion of James Bay), a subartic shallow estuary, was diverted into the La Grande River for hydroelectric development. Consequent to the diversion the estuary, which had been mostly salt-free, was subjected to a gradual saltwater intrusion along a 10-km section in its lower reaches. The adjustment of the salinity regime to a new quasi-steadystate took place over a period of about 40 days. The circulation field reached a new quasi-equilibrium within 8 days. The 2-month interval following the river diversion, the transition period, was analyzed in terms of both time and space modifications of the circulation and salinity fields. A one-dimensional finite difference explicit scheme was obtained between the model results and the low frequency current meter observations of salinity and longitudinal velocity. The salinity intrusion was primarily governed by tidal dispersion. Overall, the low-frequency response of the estuary to the rapid change in discharge occurred much more rapidly for the velocity regime than for salinity, with salinity intrusion occurring over approximately one month. Changes to the velocity regime were accomplished within a week. Modeling of the Eastmain estuary during the major transition demonstrated the capability of the model to follow satisfactorily the observed salinity changes. Numerical diffusion accounted for only a 15% addition to the calculated dispersion coefficients and might explain the higher than observed upstream salinities. (Peters-PTT)
W86-05096

MARINE BENTHOS IN RELATION TO PORE WATER CHEMISTRY AND SEDIMENT GEOCHEMISTRY OF SIMULATED DREDGED MATERIAL,
Delaware Univ., Lewes. Coll. of Marine Studies.
For primary bibliographic entry see Field 5C.
W86-05152

INFLUENCE OF COPPER IN VARIOUS FORMS ON NATURAL PHYTOPLANKTONIC POPULATIONS FROM THE SAGUENAY RIVER, QUEBEC, CANADA. (INFLUENCE DE LA SPECIATION DU CUIVRE SUR LES POPULATIONS PHYTOPLANCTONIQUES NATURELLES DE LA RIVIERE DU SAGUENAY, QUEBEC, CANADA.),
Quebec Univ., Chicoutimi. Dept. des Sciences Fondamentales.
For primary bibliographic entry see Field 5C.
W86-05162

BENTHIC MACROFAUNA ASSOCIATED WITH THE OYSTER REEFS OF THE JAMES RIVER ESTUARY, VIRGINIA, USA,
Virginia Inst. of Marine Science, Gloucester Point.
P. F. Larsen.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 6, p 797-814, 1985. 6 tab, 4 fig, 39 ref.

Descriptors: *Benthic fauna, *Oysters, *Estuaries, James River, Macrofauna, Salinity, Temperature, Species diversity.

Productive, natural oyster reefs within the James River estuary, were quantitatively sampled for associated macrofauna for one year. The James River is the southernmost tributary of the Chesapeake Bay system and contributes about 16 percent of the Bay's yearly freshwater input. It is shallow and is moderately well mixed vertically. Salinity varies about 4% between low and high water throughout the middle reaches of the estuary where the study took place. Tidal currents seldom exceed 1 m/sec. The annual temperature is about 25 C. The 192 samples yielded 142 taxa. Mean faunal density on these reefs ranged from 5,757 to 57,857/sq m. More than 77% of the individuals collected belonged to 11 taxa. The number of species and informational diversity decreased up the estuarine gradient. The quality of shell surface was deemed important in determining density. The spatial heterogeneity provided by the shell surface allowed development of a densely populated, diverse faunal assemblage which differs from soft-bottom assemblages principally in quantitative aspects. The assemblage is not spatially or temporally homogeneous and undergoes significant changes in community structure both seasonally and along the estuarine gradient. (Peters-PTT)
W86-05166

DYNAMICS OF A TIDAL ESTUARY: ESTIMATION OF THE PRINCIPAL FACTORS. (ESTIMATION DES PARAMETRES FONDAMENTAUX DE LA DYNAMIQUE D'UN ESTUAIRE A MAREES),

Centre d'Etudes d'Oceanographie et de Biologie Marine, Roscoff (France).
J.-L. Douville, and C. Riaux.
International Revue der Gesamten Hydrobiologie, Vol. 71, No. 1, 65-77, 1986. 1 tab, 6 fig, 16 ref.

Descriptors: *Tidal hydraulics, *Water currents, *Estuaries, *Saline-freshwater interfaces, Brittany, Current velocity, Mathematical studies, Topography, Freshwater discharge, Tidal range, Sediment-water interfaces, Flow pattern.

A study of tidal dynamics obtained a better understanding of the relationship between salt and freshwater masses in an estuary on the Northern Brittany coast. A simple method for calculating the mean current velocity parameter in the lower cross section of the Dour duff estuary is proposed. This model incorporates the topography of the estuary, instantaneous fresh-water discharge and the tidal range. From this model, the three parameters that characterize the flow pattern, i.e., Richardson's Froude's and Reynold's number were calculated; these parameters allow a prediction of the displacement of particles at the sediment-water interface. Salinity stratifications and the vertical gradients of current do not last long and confirm the partially to well mixed character of this sea-water dominated estuary. (Peters-PTT)
W86-05170

ANALYSIS OF A 24-HOUR CYCLE OF ZOOPLANKTON SAMPLING IN A LAGOON OF THE PO RIVER DELTA,

Parma Univ. (Italy). Ist. di Ecologia.
I. Ferrari, M. T. Cantarelli, M. G. Mazzochi, and L. Tosi.
Journal of Plankton Research JPLRD9, Vol. 9, No. 6, p 849-865, November 1985. 11 fig, 4 tab, 33 ref.

Descriptors: *Zooplankton, *Lagoons, *Po River, *Deltas, *Tidal hydraulics, Italy, Sacca del Canarin, Tidal currents, Bonifazi channel, Spring tides, Estuaries.

A 24-hour cycle of zooplankton samples, collected at spring-tide in August 1981 in a lagoon of the Po River Delta, Sacca del Canarin, is analyzed. The short-term zooplankton samples were collected, with the biocenosis represented mainly by taxa (especially copepods) coming into the lagoon from the sea and, to a lesser extent, by autochthonous zooplankton (gastropod, cirripede and decapod larvae). Density fluctuations of some taxa were influenced by hydrodynamic factors, particularly the tidal currents. A daily balance of input and output through one of the two mouths connecting the lagoon to the sea was calculated for different taxa. Quantitative estimates of zooplankton exchanges between the lagoon and the sea, due to tidal transportation, were obtained. Because of the morphological and hydrographic features of the lagoon (reduced area, wide openings to the sea), zooplankton variability depended on hydrodynamic factors and, particularly after the closure of the Bonifazi channel, on factors associated with the influence of the sea. (Peters-PTT)
W86-05179

SEASONAL FLUCTUATIONS IN THE BIOMASS AND METABOLIC ACTIVITY OF BACTERIOPLANKTON AND PHYTOPLANKTON IN A WELL-MIXED ESTUARY: THE EMS-DOLLARD (WADDEN SEA),

McGill Univ., Montreal (Quebec). Dept. of Biology.
W. Admiral, J. Beukema, and F. B. Van Es.
Journal of Plankton Research JPLRD9, Vol. 7, No. 6, p 877-890, November 1985. 7 fig, 7 tab, 39 ref.

Descriptors: *Biomass, *Phytoplankton, *Ems-Dollard Estuary, *Wadden Sea, Germany, Netherlands, Algae, Intertidal flats, Ems River, Seasonal variation, Population dynamics, Radioactive tracers, Tritium, Carbon radioisotopes, Bioassay, Bacteria analysis.

The biomass and metabolic activity of bacterioplankton were measured over one year in the Ems-Dollard Estuary, a part of the Dutch-German Wadden Sea. Very productive phytoplankton blooms, composed mainly of diatoms and the haptophycean alga Phaeocystis pouchetii, are a feature of the estuarine section studied. The estuarine section considered is 115 sq km in extent and is bordered by intertidal flats. The average water depth in the section is 6.7 meters with an average water volume of 768 cu km. The tidal fluxes are large and this, together with the discharge of the River Ems, is responsible for a flushing time of approximately one week. The production of bacterial populations, as measured using the (3-H)thymidine method broadly followed the phytoplankton density during blooms in spring and late summer. There was no indication of a disproportionate increase in bacterial production during the bloom or decline of particular algal species. The rate at which (14-C)-labelled glucose, glutamate and leucine were incorporated by bacterial populations, measured as a metabolic potential, varied seasonally, but did not precisely follow the rate of (3-H)thymidine incorporation. The utilization of the adsorbed (14-C) substrates for respiration or for cellular synthesis was constant over a prolonged period of bacterial growth. A preliminary experiment with a mixed culture of the abundantly occurring diatom species Thalassiosira excentrica and a marine spirillum, indicated that part of the algal exudates were rapidly converted by the bacteria, but another part resisted degradation. The incomplete bacterial degradation of algal exudates, together with the short residence time of the estuarine phytoplankton, may contribute to the apparently incomplete mineralization of the primary production in the water. (Peters-PTT)
W86-05181

AMMONIUM EXCRETION AND GLUTAMATE DEHYDROGENASE ACTIVITY OF ZOOPLANKTON IN GREAT SOUTH BAY, NEW YORK,

State Univ. of New York at Stony Brook. Marine Sciences Research Center.
Y. C. Park, E. J. Carpenter, and P. G. Falkowski.
Journal of Plankton Research JPLRD9, Vol. 8, No. 3, p 489-503, May 1986. 5 fig, 6 tab, 28 ref.
New York Sea Grant NA8100027.

Descriptors: *Zooplankton, *Ammonium, *Great South Bay, Long Island, New York, *Glutamate dehydrogenase, *Estuarine environment, Nutrient availability, Excretion.

In Great South Bay, on the south shore of Long Island, New York, nanoplankton accounted for the largest fraction of zooplankton glutamate dehydrogenase (GDH) activity over a one-year period. Microzooplankton and macrozooplankton accounted for 20% and 24%, respectively. Total zooplankton ammonium regeneration in Great South Bay could account for 74% of the ammonium requirement by phytoplankton in winter, but in summer when phytoplankton demand was greater, the zooplankton population was low, it supplied less than 5%. This suggests that the smallest zooplankton fraction can be the most important with regard to nitrogen regeneration in estuarine environments. Observed macrozooplankton excretion rates showed a strong correlation with the excretion rates indirectly estimated from GDH activities. The GDH/excretion ratio seems to vary depending on the internal physiological states of zooplankton as well as on food availability. The high correlation between macrozooplankton GDH activities and ammonium excretion rates, indicates that determination of GDH activity can be useful to indirectly estimate ammonium excretion rates of zooplankton, particularly microzooplankton. (Peters-PTT)
W86-05184

BIOMASS AND PRODUCTION ESTIMATES FOR AN ESTUARINE MEIOBENTHIC COPEPOD, WITH AN INSTANTANEOUS ASSESSMENT OF EXPLOITATION BY FLATFISH PREDATORS,

Orange Free State Univ., Bloemfontein (South Africa). Dept. of Dairy Science.
G. R. F. Hicks.
New Zealand Journal of Ecology, Vol. 8, p 125-127, 1985. 1 tab, 17 ref.

Descriptors: *Estuaries, *Fish, *Biomass, *Copepods, *Aquatic productivity, New Zealand, Predators, Food chain, Estuarine fisheries, Flatfish, Productivity.

Estuarine basins play a critical role as nursery areas and sheltered feeding habitats for the juveniles of a number of commercially important fish species. Estimates of functional characteristics such as biomass, production, and food web relationships are made with respect to the New Zealand estuaries. The meiobenthic harpacticoid copepod Parastenhelia megarostrum Wells, Hicks and Coull, is the dominant epibenthic metazoan on Mana Bank in Pauatahanui Inlet, Porirua Harbour. A first assessment of biomass and secondary production of the P. megarostrum population in Pauatahanui Inlet is provided and the consequences of predatory removal by flatfish are evaluated. A measurement of instantaneous predation pressure on P. megarostrum by juvenile flatfish revealed that predator abundance is highest in January. Flatfish predation probably has very little overall impact on the abundance of P. megarostrum. (Peters-PTT)
W86-05198

DIFFERENCES IN STANDING LIVE AND DEAD CROPS IN ESTUARINE MARSHES ON VANCOUVER ISLAND,

Northern Forest Research Centre, Edmonton (Alberta).
K. A. Kennedy, and V. C. Brink.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 2, p 322-325, February 1986. 4 fig, 1 tab, 12 ref.

Descriptors: *Estuarine environment, *Standing crops, *Marshes, *Vancouver Island, British Columbia, Detritus, Estuaries, Food chain, Plant populations.

The purpose of this study was to determine the standing crops of vascular plants in estuaries on the east coast of Vancouver Island, British Columbia. Carex lyngbyei Hornmen. stands did not have standing dead crops for the final 5 months of the 7-month study, though C. lyngbyei stands produced the most matter (i.e., a peak standing live crop of 1450 g dry matter/sq m). In a Salicornia virginica L. stand, the standing dead crop exceeded the standing live crop throughout the study and the stand had the greatest amount of dead matter with a peak standing dead crop of 1470 g dry matter/sq m. This suggested that vascular plant matter produced in the C. lyngbyei stands was more likely to enter the detrital food web of an estuary than was matter produced in the S. virginica stand. (Lantz-PTT)
W86-05348

OVERVIEW OF THE HYDROLOGIC CONCERNS RELATED TO WETLANDS IN THE UNITED STATES,

Connecticut Univ., Storrs. Ecology Section.
For primary bibliographic entry see Field 2H.
W86-05349

ESTUARINE, COASTAL AND OCEAN POLLUTION: EEC POLICY AND RESEARCH,

Commission of the European Communities, Brussels (Belgium). Directorate General for Research, Science and Education.
For primary bibliographic entry see Field 5G.
W86-05352

DEVELOPMENT, TESTING AND INTERCALIBRATION OF REFERENCE METHODS FOR POLLUTION STUDIES IN COASTAL AND ESTUARINE WATERS,

International Lab. of Marine Radioactivity, Monaco-Ville (Monaco).
For primary bibliographic entry see Field 5C.
W86-05354

ANALYTICAL QUALITY CONTROL (AQC) FOR MONITORING TRACE METALS IN THE COASTAL AND ESTUARINE ENVIRONMENT,

Water Research Centre, Marlow (England).
For primary bibliographic entry see Field 5G.
W86-05355

STANDARDIZATION OF WATER QUALITY INFORMATION IN A TIDAL RIVER,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-05356

MONITORING EFFECTS OF CATCHMENT MANAGEMENT PRACTICES ON PHOSPHORUS LOADS INTO THE EUTROPHIC PEEL-HARVEY ESTUARY, WESTERN AUSTRALIA,
Western Australia Dept. of Conservation and Environment, Perth.
For primary bibliographic entry see Field 5B.
W86-05357

EFFECTIVENESS OF SAMPLING STRATEGIES FOR INTERTIDAL MONITORING,
Victoria Univ. of Manchester (England). Dept. of Zoology.
For primary bibliographic entry see Field 7B.
W86-05358

SOME RECENT DEVELOPMENTS IN THE CHARACTERIZATION OF ESTUARINE PARTICULATES,
Ecole Normale Superieure, Paris (France). Lab. de Geologie.
For primary bibliographic entry see Field 5A.
W86-05360

SOLUTE DISPERSION AND SEDIMENT TRANSPORT IN ESTUARIES,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-05361

INVESTIGATION OF MATERIAL TRANSPORT AND LOAD IN TIDAL RIVERS,
GKSS - Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik.
For primary bibliographic entry see Field 5B.
W86-05362

SEDIMENT MOBILITY AND ITS CONTRIBUTION TO TRACE METAL CYCLING AND RETENTION IN A MACROTIDAL ESTUARY,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5B.
W86-05363

CHEMICAL FRACTIONATION OF HEAVY METALS IN ANOXIC ESTUARINE AND COASTAL SEDIMENTS,
Technische Univ. Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik.
For primary bibliographic entry see Field 5B.
W86-05364

CADMIUM AND LEAD CYCLING BETWEEN WATER, SEDIMENT, AND BIOTA IN AN ARTIFICIALLY CONTAMINATED MUD FLAT ON BORKUM (F.R.G.),
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 5B.
W86-05365

DISTRIBUTION OF MERCURY IN THE SEDIMENTS AND FISHES OF THE LAGOONS OF AVEIRO, PORTUGAL,
Aveiro Univ. (Portugal). Dept. de Quimica.
For primary bibliographic entry see Field 5B.
W86-05366

BACILLUS PHAGES AS TRACERS OF WATER MOVEMENT,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 5B.
W86-05367

MERCURY CONTAMINATION IN COMPONENTS OF AN ESTUARINE ECOSYSTEM,
Forth River Purification Board, Queensferry (Scotland).
For primary bibliographic entry see Field 5C.
W86-05369

MERSEY ESTUARY (U.K.) BIRD MORTALITIES - CAUSES, CONSEQUENCES AND CORRECTIVES,
North West Water Authority, Warrington (England).
For primary bibliographic entry see Field 5C.
W86-05370

ECOLOGICAL IMPACTS OF THE CONSTRUCTION OF DAMS IN AN ESTUARY,
Rijkswaterstaat-Deltadienst, Middelburg (Netherlands). Hoofdafdeling Milieu en Inrichting.
For primary bibliographic entry see Field 6G.
W86-05371

IMPACT OF TRIBUTYL TIN (TBT) ANTI-FOULING PAINTS ON MOLLUSCAN FISHERIES,
Brest Univ. (France). Lab. d'Oceanographie Biologique.
For primary bibliographic entry see Field 5C.
W86-05372

STEADY STATE AND TIME-VARYING WATER QUALITY MODELS FOR THE HOOGHLY ESTUARY, INDIA,
Calcutta Metropolitan Development Authority (India).
For primary bibliographic entry see Field 5B.
W86-05378

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

REVERSE OSMOSIS MODULES FOR WATER DESALINATION,
Toyobo Co. Ltd., Otsu (Japan).
M. Sekino, K. Matsunaga, K. Gotoh, Y. Yanaga, and H. Nikko.
Chemical Engineering Progress, Vol. 81, No. 12, p 52-56, December, 1985. 5 fig, 4 tab, 8 ref.

Descriptors: *Reverse osmosis, *Desalination, *Water reuse, Toyobo modules, Japan, Middle East, Water treatment, Saline water, Drinking water.

In Japan, since September 1979, an 800 cu m/d desalination plant has been in operation at Water Reuse Promotion Center Chigasaki Testing Ground. The 8 in. diameter modules made by Toyobo are being used in this plant. A feasibility study has been conducted for more than five years. Performance tests for the 12 in. diameter multielement reverse osmosis modules began 2.5 years ago. Long term results at various manufacturers of plant facilities using Hollosep were determined. In a desalination plant producing 2,000 cu m/d of pure water, the product water costs $2.00/cu m. The sea that surrounds the Arabian Peninsula offers high-temperature, high-concentration seawater. Trailer-mounted-type reverse osmosis seawater desalination units have been put to the feasibility test in this area. Drinking water made from the Toyobo reverse osmosis seawater desalination units produced high-quality fresh water from high-temperature, high-concentration seawater. The results of bacteria removal and pyrogen removal test for high-flux-type modules are shown. Long-range endurance tests on Yoyobo reverse osmosis modules confirm: (1) It obtained required volume and required quality of desalinated water in ordinary seawater desalination. (2) Seawater desalination process was successful in the Middle East countries. (3) Pyrogen-free pure water application, product water was produced for medical and pharmaceutical needs. (Main-PTT)
W86-05259

3B. Water Yield Improvement

OBSERVATIONAL RAINFALL-RUNOFF ANALYSIS FOR ESTIMATING EFFECTS OF CLOUD SEEDING ON WATER RESOURCES IN NORTHERN ISRAEL,
Tel-Aviv Univ. (Israel). Dept. of Statistics.
Y. Benjamini, and Y. Harpaz.
Journal of Hydrology, Vol. 83, No. 3/4, p 299-306, March 1986. 3 fig, 9 ref.

Descriptors: *Rainfall-runoff relationships, *Israel, *Cloud seeding, Water resources, Galilee, Catchment basins, Springs, Regression analysis, Runoff rates, Streams, Mathematical studies.

The main objective of the rain enhancement program implemented in Israel over the past 24 years is augmentation of its scarce water resources. The program comprises randomized cloud seeding experiments and operational seeding. A method of evaluating the hydrological effectiveness of this program by a rainfall-runoff method was developed and applied to 26 water sources (springs and streams) within the Galilee target area. Double regression analysis was performed on each water source, first between the runoff and its catchment-basin rainfall in the target area and then between the same runoff and a control rainfall. Comparisons were made between seeding and pre-seeding periods. The Jackknife technique was used to determine the statistical significance of the runoff increments. Evaluation for the last 13 years of cloud seeding indicates only weak overall runoff increase, though results of individual sources were not rated adequately significant. Median runoff increments for the six target zone range from 0 to 14%, whereas power calculations show that runoff changes higher than 20-25% could have been detected by this method. (Peters-PTT)
W86-05115

RAINWATER FOR DRINKING IN SRI LANKA,
Loughborough Univ. of Technology (England). WEDC Group.
A. Cotton.
Aqua AQUAAA, No. 2, p 72-76, 1986. 1 fig, 4 tab, 10 ref, 1 append.

Descriptors: *Rain, *Drinking water, *Sri Lanka, Domestic water, *Water supply development, Rainfall, Water supply, Cost analysis, Potable water.

This paper describes the potential use of collecting household rainwater, to provide drinking water for rural areas of Sri Lanka where water supply presents severe problems. Rainfall data from five climatically different regions are analyzed, and it is shown that the water requirements for drinking and cooking can be satisfied without the need for unduly large storage. It is assumed that traditional sources would continue to be used for bathing. The average incremental costs are high, varying between US $1.00 to $1.42/ cu m. The data presented are currently being used to start up a small pilot program in Sri Lanka, in which one of the main aims will be to ascertain householders' response to rainwater collection. A great advantage of household rainwater collection is that maintenance is the responsibility of householders, and not of a government agency. (Lantz-PTT)
W86-05145

3C. Use Of Water Of Impaired Quality

SIMULATED CROP-WATER PRODUCTION FUNCTIONS FOR SEVERAL CROPS WHEN IRRIGATED WITH SALINE WATERS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
J. Letey, and A. Dinar.
Hilgardia, Vol. 54, No. 1, p 1-32, January 1986. 4 tab, 21 fig, 33 ref, 2 append.

Descriptors: *Saline water, *Crop production, *Irrigation, Simulation, Alfalfa, Cauliflower, Celery, Corn, Cowpea, Lettuce, Oats, Sugarbeet, Tomato, Wheat, Mathematical models, Evapotranspiration.

A model was developed to formulate crop water production functions when irrigating with saline waters. Crop water production functions are computed from the model for several crops. Three relationships are combined: yield and evapotranspiration, yield and average root zone salinity, and average root zone salinity and leaching fraction. The model allows plant growth adjustment, and evapotranspiration adjustment, to root zone salinity. Using the model, product functions were computed for several crops. Calculated relative yields were compared with measured relative yields from experiments that had water quality and quantity as variables. Reasonable agreement between the two values provides some assurance of the model's utility and reported production functions under field conditions. The crops used included alfalfa, cauliflower, celery, corn, cowpea, lettuce, oats, sugarbeets, tomato and wheat. The production functions as presented are for uniform water application. In the case of nonuniformity, which is typical of agricultural field crops, the ultimate relationship between average applied water and yield can be significantly different from those presented. (Peters-PTT)
W86-04690

SOME OBSERVATIONS ON THE EFFECTS OF SALINITY ON ION DISTRIBUTIONS AND CELL ULTRASTRUCTURE IN WHEAT LEAF MESOPHYLL CELLS,
Sussex Univ., Brighton (England). School of Biological Sciences.
D. M. R. Harvey, and J. R. Thorpe.
Journal of Experimental Botany, Vol. 37, No. 174, p 1-7, January 1986. 2 tab, 38 ref.

Descriptors: *Salinity, *Wheat, Agriculture, Salinity sensitivity, Ion concentrations, Plant Physiology, Agronomy.

The distribution of ions in wheat leaf mesophyll cells from plants grown in saline conditions wasd studied and the results related to changes in the volume fractions occupied by the analyzed cell compartments. The plants were grown in the presence of 100 mol per cm NaCl; the distribution of ions were determined by X-ray microanalysis. Generally, the cells did not accumulate high ion concentrations in their vacuoles, and the much higher Na and Cl concentrations in the cell walls would produce an imbalance of cell water relations. The Na, K, and Cl concentrations in the cytoplasm were often too high to be compatible with biochemical activity. In response to saline growth conditions, the volume fractions occupied by the cytoplasm and chloroplasts increased. (Peters-PTT)
W86-04699

RIVER DEE SCHEME AND INTAKE PROTECTION SYSTEMS,
North West Water Authority, Warrington (England).
For primary bibliographic entry see Field 5F.
W86-04752

INFORMATIONAL/EDUCATIONAL APPROACHES TO PUBLIC ATTITUDES ON POTABLE REUSE OF WASTEWATER,
Denver Research Inst., CO.
For primary bibliographic entry see Field 5D.
W86-04827

TRACKING SALTY SOIL, SAVING FRESH WATER,
D. Senft.
Agricultural Research, Vol. 34, No. 1, p 7-10, January 1986.

Descriptors: *Mapping, *Salinity, *Irrigation, *Conductivity, *Farm management, *Soil management, *Soil solution, *Electronic equipment, Water table, Leaching fraction, Field tests, Groundwater salinity, Computer simulation, Cotton, Sugar beets, Melons, Wheat, Agricultural Research Service, Crop yield.

Agricultural Research Service scientists are studying areas of high soil salinity using measurement probes and mapping techniques under development to eliminate much of the need for soil sampling and laboratory analysis. Map overlay techniques are employed to display water table depth, soil permeability, leaching fraction (the amount of excess irrigation water applied to leach salts below the route zone), and groundwater salinity. With maps displaying these features farmers will be able to locate areas on their land where salt problems are likely to occur. The measurement probe currently in use employs conductivity to indicate salt level in the soil. A probe under development uses an electromagnetic probe to generate a current flow in the soil. With the second probe, contact with the soil is unnecessary, and it eventually may be possible to measure soil salinity from an all-terrain vehicle or low-flying aircraft using this device. Crop rotation strategies are being developed to make better use of brackish water for irrigation. Cotton, sugar beets, melons, and wheat have been tested in field trials of crop rotation, and a computer simulation model has been developed to aid in predicting the effects of irrigation waters of different salinities on crop growth. (Rochester-PTT)
W86-04982

OPTIMAL RATIOS OF SALINE AND NONSALINE IRRIGATION WATERS FOR CROP PRODUCTION,
Agricultural Research and Education Center, Jay, FL.
A. Dinar, J. Letey, and H. J. Vaux, Jr.
Soil Science Society of America Journal, Vol. 50, No. 2, p 440-443, March/April 1986. 1 tab, 3 fig, 8 ref.

Descriptors: *Saline water, *Crop production, *Irrigation, Salinity, Salt tolerance, Economic efficiency, Water mixing, Alfalfa, Cauliflower, Celery, Corn, Cotton, Cowpea, Lettuce, Oats, Sugarbeet, Tomato, Wheat, Conductivity, Costs, Water costs.

A quantitative method for determining the optimal mix of saline and nonsaline waters for crop production is presented. Equal yield curves (isoquants), which quantify the extent of substitutability between waters of different qualities when constant yield is sought, were derived from crop water production functions for waters of different qualities computed from a previously published model. Isoquants were derived for several crops (alfalfa, cauliflower, celery, corn, cotton, cowpea, lettuce, oats, sugarbeet, tomato, and wheat) for relative yield (RY) values of 1.0, 0.9, and 0.8. The waters considered for mixing were nonsaline waters and waters of electrical conductivity (EC) equal to 4, 6, or 11 dS/m. Extending the supply of water by combining nonsaline and saline water is not always technically or economically feasible, and depends on specific crop and water pricing situations. The technical and economic feasibility of mixing waters of different quality increases as the EC of the saline water decreases, crop tolerance to salinity increases, desired RY decreases, or the relative price of saline to nonsaline water decreases. (Peters-PTT)
W86-05126

EVAPORITE MINERALOGY ASSOCIATED WITH SALINE SEEPS IN SOUTHWESTERN NORTH DAKOTA,
University of East Anglia, Norwich (England). School of Environmental Sciences.
M. E. Timpson, J. L. Richardson, L. P. Keller, and G. J. McCarthy.
Soil Science Society of America Journal, Vol. 50, No. 2, p 490-493, March/ April 1986. 5 tab, 2 fig, 25 ref.

Descriptors: *Saline Soils, *North Dakota, *Evapotranspiration, *Leaching, Evaporites, Saline-sodic soils, Saline seeps, Magnesium, Root zone, Soil profiles, Solubility, Seasonal variation, Cropland.

The evaporite minerals present in the saline seeps of Hettinger County, southwestern North Dakota were characterized. Saline seepage occurs when water in excess of crop use leaches soluble salts from the root zone and transports them laterally to lower landscape positions. Evapotranspiration moves these dissolved salts upward through the soil, resulting in salt crust formation at the surface. The mineralogic composition of the saline efflorescences present at the soil surface of four saline seeps in Hettinger County, ND were determined. Mineralogic changes resulting from upward water movement in soils were accurately predicted using the Hardie-Eugster model of closed basin brine evolution. The sequence calcite-gypsum-and mixed Na-Mg-(SO4) minerals occurs as saline waters migrate upward through the profile. The following minerals occur in surface ($NaMg(SO_4)2.4H_2O$), konyaite ($Na_2Mg(SO_4)2.5H_2O$, loewite $Na_{12}Mg_7(SO_4)_{13}.15H_2O$), and gypsum. Hydration state, mineral occurrence, and mineral solubility were seasonally dependent. (Peters-PTT)
W86-05128

CHEMICAL REACTIONS WITHIN ROOT ZONE OF ARID ZONE SOILS,
California Univ., Davis. Water Science and Engineering Section.
For primary bibliographic entry see Field 5B.
W86-05233

SALT PROBLEMS FROM INCREASED IRRIGATION EFFICIENCY,
Agricultural Research Service, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 5B.
W86-05234

LAND APPLICATION OF DOMESTIC WASTEWATER, WOOD PRODUCTION, AND SLUDGE COMPOSTING: AN INTEGRATED DESIGN,
Nebraska Univ.-Lincoln. Dept. of Civil Engineering.
G. B. Keefer, and M. W. Gilliland.
Resources and Conservation, Vol. 12, p 13-27, August 1985. 3 fig, 1 tab, 20 ref.

Descriptors: *Sludge disposal, *Composting, *Wood, Domestic wastewater, Waste disposal, Omaha, Hydraulic loading, Nitrogen loading, Land Disposal, Nebraska, Water reuse.

A process which combines land treatment of wastewater following primary sedimentation, with tree production and sludge composting, was evaluated for land requirements. The sludge composting process generally utilizes a bulking material to reduce the moisture content and increase the carbon/ nitrogen ratio of the sludge. The cost of the bulking material, which is often woodchips, can represent a substantial portion of the total system operating cost. Growing trees in the land application system produces both woodchips for composting, and firewood, for which there may be a market. Background information, including design criteria, is given for the land application and composting processes. In addition, laws and regulations pertaining to both processes are reviewed. The general range of land area necessary to apply a wastewater flow of 0.044 cu m/s was determined for the Omaha, Nebraska area. Hydraulic loading and nitrogen loading parameters were included in the analysis. Calculations showed that 25-320 hectares would be required according to the hydraulic loading criteria while 41-85 hectares would be

required according to the nitrogen loading criteria. Only 2.2-11.2 hectares would be needed to grow enough trees in order to produce woodchips. Thus, the majority of land under irrigation could be used for the production of firewood. (Master-PTT).)
W86-05293

WASTEWATER TREATMENT USING AQUATIC PLANTS. SURVIVABILITY AND GROWTH OF SALVINIA MOLESTA (MITCHELL) OVER WATERS TREATED WITH ZINC (II) AND THE SUBSEQUENT UTILIZATION OF THE HARVESTED WEEDS FOR ENERGY (BIOGAS) PRODUCTION,
Centre for Water Resources Development and Management, Kunnamangalam (India).
For primary bibliographic entry see Field 5D.
W86-05294

3D. Conservation In Domestic and Municipal Use

SALVAGING A WATER RESERVOIR,
Overman (W.C.) Associates, Virginia Beach, VA.
For primary bibliographic entry see Field 8A.
W86-04739

DURABLE CHEMICAL GROUT SOLVES 'CASE OF THE DISAPPEARING LAKE',
For primary bibliographic entry see Field 8A.
W86-04742

DAILY WATER USE IN NINE CITIES,
Texas Univ. at Austin. Dept. of Civil Engineering.
D. R. Maidment, and S. -P. Miaou.
Water Resources Research WRERAO, Vol. 22, No. 6, p 845-851, June 1986. 3 fig, 4 tab, 7 ref. NSF Grant CEE 82-04761.

Descriptors: *Water use, Data acquisition, Data interpretation, Municipal water, Rainfall, Air temperature, Pennsylvania, Texas, Florida, Water management, Model studies, Forecasting, Planning.

Daily water use data from nine cities were studied (three cities each from Florida, Pennsylvania, and Texas) using transfer functions, to model the short-term response of daily municipal water use to rainfall and air temperature variations. The dynamic response of water use to rainfall and air temperature is similar across the cities within each State; in addition the responses of the Pennsylvania cities is more sensitive to air temperature and less to rainfall. There is little impact of city size on the response functions. The response of water use to rainfall depends first on the occurrence of rainfall and second on its magnitude. The occurrence of a rainfall more than 0.05 in/day (0.13 cm/day) causes a drop in the seasonal component of water use one day later that averages 38% for the Texas cities, 42% for the Florida cities, and 7% for the Pennsylvania cities. In Austin, Texas, a spatially averaged rainfall series shows a clearer relationship with water use than does rainfall data from a single gage. There is a nonlinear response of water use to air temperature changes with no response for daily maximum air temperature between 40 and 70 F (4-21 C); an increase in water use with air temperature beyond 70 F; above 85-90 F (29-32 C) water use increases 3-5 times more per degree than below that limit in Texas and Florida. The model resulting from these studies can be used for daily water use forecasting and water conservation analysis. (Lantz-PTT)
W86-05241

BETTER ACCOUNTING FOR UNACCOUNTED FOR WATER,
Wessex Water Authority, Poole (England).
J. E. Philip.
Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 6, p 475-484, December 1985. 3 fig, 4 tab, 8 ref.

Descriptors: *Leakage, *Water use, *Water metering, *Monitoring, Water consumption, Error analysis, Flow rates.

Results are presented of studies carried out in Wessex Water Authority on domestic consumption by monitoring houses in small groups of similar rateable value. Twelve groups of 24 houses were studied from 1983-1984 to improve data on the household domestic use of water and to develop a simple model to allow the use of this information in unaccounted for water (UFW) calculations applicable to each supply area within the Authority. For the 12 groups of houses in the study, the average minimum night flow was 2.9 liter/property/hr. In view of the variation in supply taken from storage, the age of ball valves and to avoid over estimation, a minimum night flow of 2.4 liter/property/hr was proposed for the Wessex region. Major weakness in using the total integrated flow equation for estimating UFW include errors in the measurement of metered quantities, population estimate errors, seasonal variation in water use, and lack of data on average domestic consumption. To improve results in estimating UFW the Authority will monitor groups of houses to gather data on average domestic consumption, and upgrade night exercises to read all the meters in the supply zone to improve the estimates of night flow rates applicable to various classes of metered users based on average daily flows. (Geiger-PTT)
W86-05315

3F. Conservation In Agriculture

TRACKING SALTY SOIL, SAVING FRESH WATER,
For primary bibliographic entry see Field 3C.
W86-04982

INVESTIGATION OF WATER MOVEMENT IN THE UNSATURATED ZONE UNDER AN IRRIGATED AREA USING ENVIRONMENTAL TRITIUM,
Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotope Research.
For primary bibliographic entry see Field 2G.
W86-05210

ROLE OF SUSPENDED SEDIMENT IN IRRIGATION RETURN FLOW CHEMISTRY, SOUTHERN ALBERTA,
Department of Energy, Mines and Resources, Ottawa (Ontario).
For primary bibliographic entry see Field 5B.
W86-05211

REPORT OF TASK COMMITTEE ON WATER QUALITY PROBLEMS RESULTING FROM INCREASING IRRIGATION EFFICIENCY.
American Society of Civil Engineers, New York. Irrigation and Drainage Div.
For primary bibliographic entry see Field 5G.
W86-05231

DRAINAGE REQUIRED TO MANAGE SALINITY,
Agricultural Research Service, Riverside, CA. Salinity Lab.
G. J. Hoffman.
Journal of Irrigation and Drainage Engineering JIDEDH, Vol. 111, No. 3, p 199-206, September 1986. 3 fig, 1 tab, 18 ref.

Descriptors: *Saline water, *Drainage programs, Crop yield, Impaired water use, Saline soils, Mathematical analysis, Leaching, Root zone, Model studies, Correlation coefficient.

The amount of drainage required to prevent loss in crop productivity from excess soil salinity has been termed as the leaching requirement (L sub gamma). Several steady-state models that have been proposed to predict the L sub gamma, to avoid a loss in crop yield from excess soil salinity, were compared with experimentally measured values for a number of crops. The exponential model, based upon an exponential pattern of crop water uptake, correlated best with the measured values but underestimated at high L sub gamma's. A simplified model that approximates an average soil salinity based on values for the top and bottom of the root zone also gave acceptable estimates. The highest correlation coefficient between predicted and measured values of L sub gamma was 0.67, indicating that none of the models is completely satisfactory. (Lantz-PTT)
W86-05232

EFFECT OF IRRIGATION EFFICIENCIES ON NITROGEN LEACHING LOSSES,
Delaware Univ., Newark. Dept. of Agricultural Engineering.
W. F. Ritter, and K. A. Manger.
Journal of Irrigation and Drainage Engineering JIDEDH, Vol. 111, No. 3, p 230-240, September 1985. 35 ref.

Descriptors: *Irrigation efficiency, *Leaching, *Nitrogen, Nitrates, Irrigation practices, Water management, Chemical analysis, Fertilizers, Soil texture, Models, Irrigation effects, Humid areas.

A literature review was conducted to determine the effect increasing irrigation efficiencies have had on NO3-N leaching. The mass of NO3-N leached is directly related to drainage volume. By increasing irrigation efficiencies, both the drainage volume and amount of NO3-N leaching are reduced. Both water management and nitrogen management are important in controlling NO3-N leaching. By using improved water management practices that control of amount of water applied, and using the proper time to apply water, the irrigation efficiency is increased and NO3-N leaching is reduced. Applying only enough N fertilizer to meet crop requirements for a realistic yield goal, time of application, and use of slow release fertilizers are N management practices that will reduce NO3-N leaching. However, it is impossible to reduce NO3-N leaching to zero in the humid region on coarse-textured soils and still maintain adequate crop yields. Nitrogen simulation models cannot be widely used to evaluate N management practices and irrigation water management practices that increase irrigation efficiencies because of the lack of required input data. (Lantz-PTT)
W86-05235

BASIN-WIDE IMPACTS OF IRRIGATION EFFICIENCY,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
L. S. Willardson.
Journal of Irrigation and Drainage Engineering JIDEDH, Vol. 111, No. 3, p 241-246, September 1985. 6 ref.

Descriptors: *Irrigation efficiency, *Irrigation effects, *Basins, *River basins, Water quality, Return flow, Leaching, Percolation, Salinity, Irrigation-return flow.

Irrigation efficiency is one of the important factors affecting river basin water quality. Questions frequently arise as to whether increasing irrigation efficiency in a basin will have a net positive or negative effect on basin water quality. Quality and quantity of return flow from irrigation are related to irrigation efficiencies and leaching fractions. River basins have leaching fractions analogous to irrigation leaching fractions inasmuch as salts generated by mineral weathering and those dissolved by percolating waters are carried out of the basin by a fraction of the precipitation falling on the basin. Reducing the leaching fraction of a basin by increasing irrigation efficiency and consuming more water in the basin, will decrease downstream water quality and quantity. Irrigation efficiency, as a salinity control measure, must be considered in the context of total water management to be properly interpreted. (Lantz-PTT)
W86-05236

AUTOMATIC THROTTLE HOSE - NEW FLOW REGULATOR,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
P. U. Volkart, and F. de Vries.
Journal of Irrigation and Drainage Engineering

JIDEDH, Vol. 111, No. 3, p 247-264, September 1985. 15 fig, 1 tab, 11 ref, append.

Descriptors: *Automatic Throttle Hose, *Flow regulators, Irrigation engineering, Storm water, Design standards.

Flow regulators in both irrigation and storm water engineering are often not very exact, but should be simple to construct and maintain, 'fool-proof,' and ideally inexpensive. A new flow regulator which matches these requirements, the so-called Automatic Throttle Hose, is described. The device delivers an almost constant discharge independent of fluctuations in the upstream water level. No external power supply is needed for running the device, as it takes all required energy from the fluid itself. Following an explanation of the regulating principle, the application of this new regulator to irrigation practice is described and a design chart for application in the low head range presented. Further, modifications are listed which may be used to extend the effective head range. Practical experiences in both irrigation schemes and storm water projects indicate that this flow regulator has a place alongside other proven regulators for rather low discharges. (Lantz-PTT)
W86-05237

IRRIGATION WATER REQUIREMENTS FOR SENEGAL RIVER BASIN,
Army Engineer District, New York.
For primary bibliographic entry see Field 6D.
W86-05238

PLASTIC LINING ON RIVERTON UNIT, WYOMING,
For primary bibliographic entry see Field 8G.
W86-05240

IRRIGATED AGRICULTURE AND GROUNDWATER MINING ON THE HIGH PLAINS OF TEXAS, USA,
Saint David's Univ. Coll., Lampeter (Wales).
For primary bibliographic entry see Field 4B.
W86-05283

OUTPUT AND INVESTMENT FRONTIERS OF UNITED STATES IRRIGATED AGRICULTURE,
Idaho Univ., Moscow. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6C.
W86-05326

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

INGENUITY SOLVES THE CITY'S DRAINAGE AND RECREATIONAL SPACE NEEDS,
D. L. Pilz.
Public Works, Vol. 117, No. 3, p 80, 113, March 1986.

Descriptors: *Detention reservoirs, *Storm runoff, *Financing, *Recreation, Portage, Indiana, Flood protection, Storm sewers, Bond tissue.

The city of Portage, Indiana, simultaneously solved problems of poor drainage facilities in suburban areas and lack of neighborhood parks by combining the two facilities. Park bonds were used for land acquisition and general obligation bonds were used to construct drainage facilities, including a pond at each of the two sites. The Lenburg project consists of a dry-type stormwater detention area and small active recreation areas, with the detention basin sculptured for a more natural look. The second project, Bender, included new interceptor storm sewers and a 3.6-acre pond with 1,500-ft discharge sewer to carry the overflow, all on a 32-acre site. Land cost 1 million dollars at each site; drainage facilities cost 33,200 dollars at Lenburg and 771,000 dollars at Bender. (Rochester-PTT)
W86-04737

DETENTION PONDS: THE POSITIVE AND THE NEGATIVE,
Overman (W.C.) Associates, Virginia Beach, VA.
R. M. Silver.
Public Works, Vol. 117, No. 4, p 40-41, April 1986. 1 fig.

Descriptors: *Detention reservoirs, *Maintenance, *Aquatic plants, *Sedimentation, *Flood peak, Mosquitoes, Surface runoff, Hydroelectric power, Groundwater recharge, Erosion control, Oxygen deficit.

A detention pond is a facility, natural or artificial, that provides temporary storage for surface runoff, accompanied by its controlled release. Reduction of peak flows, water supply augmentation, electrical power, recreation, replenishment of groundwater, decrease in soil erosion, better control of sediment deposition, improvement of receiving water quality, and ease of implementation in planned developments are among the benefits of detention ponds. Without a well-planned overall design, releases from multiple ponds may create delayed peak flows, which at some points downstream actually may be higher than natural flows. Steep bank slopes can make it difficult to establish good vegetative cover, whereas slopes that are too flat can cause the land to be soggy and marsh-like, encouraging mosquitoes. Shallow water depths promote uncontrolled weed growth within the pond, and because of the decay of this vegetation, the pond becomes deficient in oxygen and polluted, and will not sustain aquatic life. Periodic maintenance is necessary to control sediment buildup and maintain pond water quality. (Rochester-PTT)
W86-04738

DAILY FLOW STATISTICS OF ALASKAN STREAMS,
National Weather Service, Anachorage, AK. Alaskan River Forecast Center.
D. L. Chapman.
Available from the National Technical Information Service, Springfield, VA. 22161, as PB83-180133, Price codes: A05 in paper, A01 in microfiche. NOAA Technical Memorandum NWS AR-35, October 1982. 57 p, 2 fig, 2 ref.

Descriptors: *Flow rates, *Statistics, *Statistical analysis, *Streams, *Alaska, Hydrographs, Hydrography.

Frequent requests to compare current river flow to the normal flow, when to expect spring breakup, when to expect the highest flow for the year, etc., led to a statistical analysis of daily flows at all Alaskan stations for which sufficient discharge records were available. Some of the results were plotted and are presented graphically for quick-look reference. The purpose of this report is to present full-year hydrographs of the mean flow for each date, the flow that can be expected to be exceeded nine times out of ten on average for each data, and the flow that can be expected to be exceeded only one time in ten. A secondary purpose is to demonstrate, by examples, how to interpret the hydrographs for guidance in answering questions like the above. (Lantz - PTT)
W86-04784

ADVANCES IN HYDROMETRY.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 7B.
W86-04785

HADDINGTON FLOOD WARNING SYSTEM,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 7B.
W86-04808

AUTOMATION OF DAILY WATER DISCHARGE COMPUTATION FOR RIVERS WITH DIFFERENT REGIMES,
Sredneaziatskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Inst., Tashkent (USSR).
For primary bibliographic entry see Field 7C.
W86-04814

ENTRAINMENT DESCRIPTIONS FOR MATHEMATICAL MODELING OF PUMPED-STORAGE INFLOWS IN RESERVOIRS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
For primary bibliographic entry see Field 8B.
W86-04940

CHARACTERIZATION OF HYDROGRAPH RECESSIONS OF LAND DRAINS,
Rothamsted Experimental Station, Harpenden (England). Dept. of Soils and Plant Nutrition.
E. G. Youngs.
Journal of Hydrology, Vol. 82, No. 1/2, p 17-25, November 30, 1985. 7 fig, 1 tab, 6 ref.

Descriptors: *Hydrograph analysis, *Land drains, Discharge hydrographs, Soil water table, Permeability coefficient, Specific yield, Drain spacing, Drainage practices, Mathematical analysis.

A relationship between the drain-flow rate and time during the water-table recession in uniform soils drained by parallel drain lines is derived from a power-law drainage equation. This relationship shows that the non-steady drainage behavior can be characterized by two parameters, one that depends on the spacing of the drains and their height above an impermeable floor, and the other that depends also on the hydraulic conductivity and specific yield of the soil. When these are plotted on logarithmic graph paper, the results indicate that field drains can be analyzed to give the characteristic parameters by superimposing them on type curves of the theoretical relationship plotted on similar paper. Drain hydrograph recessions can provide a simple means of monitoring soil structure changes over seasons and years; the graphical method of analysis provides easy indices for this purpose. (Khumbatta-PTT)
W86-05073

APPROACH FOR FREQUENCY ANALYSIS OF MULTIYEAR DROUGHT DURATIONS,
Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W86-05212

FLOOD FREQUENCY ANALYSIS USING THE COX REGRESSION MODEL,
Interstate Commission on the Potomac River Basin, Rockville, MD.
For primary bibliographic entry see Field 2E.
W86-05248

EFFECT OF SERIAL CORRELATION ON RESERVOIR SIZE,
Monash Univ., Clayton (Australia).
For primary bibliographic entry see Field 2H.
W86-05253

4B. Groundwater Management

GROUNDWATER RECHARGE ESTIMATE BY NUMERICAL MODELING: A CASE STUDY,
Port Harcourt Univ. (Nigeria). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W86-05146

IRRIGATED AGRICULTURE AND GROUNDWATER MINING ON THE HIGH PLAINS OF TEXAS, USA,
Saint David's Univ. Coll., Lampeter (Wales).
P. Beaumont.
Environmental Conservation, Vol. 12, No. 2, p

119-130, 1985. 12 fig, 1 tab, 28 ref.

Descriptors: *Groundwater mining, Groundwater irrigation, *Irrigation efficiency, *Agriculture, Texas, Aquifers, Ogallala aquifer.

The rise and possible fall of groundwater irrigated agriculture on the High Plains are outlined in both temporal and spatial contexts, with attention focused on how Man's view of the resource he has been exploiting has changed. The major aquifer of the Texas High Plains is the Ogallala Formation, consisting of unconsolidated sands, silts, and clays. The early history of the Great Plains and the growth of irrigated agriculture are discussed, and charts outlining the water table decline of the Ogallala are presented. The early perceptions of the water resources available were those of a limitless aquifer, which meant that there was no need for water conservation. By the early 1960s, as well-water levels declined, the finiteness of the aquifer became clear and sprinkler irrigation was introduced as a conservation measure. Farmers began to accept, or even welcome, state intervention in supplying water from outside the Ogallala. Present trends indicate a shift from groundwater irrigation to a return to dry farming. (Master-PTT).)
W86-05283

SUBMERSIBLE PUMPS HELP IMPROVE WATER SUPPLY FROM DEEP LIMESTONE WELL,
Bluffton Electrical and Water Utilities Dept., IN.
For primary bibliographic entry see Field 8C.
W86-05320

SINKING CITIES,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
R. Dolan, and H. G. Goodell.
American Scientist, Vol. 74, No. 1, p 38-47, January-February 1986. 7 fig, 1 tab, 35 ref.

Descriptors: *Flooding, *Subsidence, *Groundwater mining, *Urban areas, Groundwater depletion, Structural engineering, Structural geology, Structural settlement, Flood plains, Dikes, Sea level.

Many of the world's great cities are sinking because of the removal of groundwater and oil and gas beneath them. Differential subsidence and lateral movements of the earth have dislocated utilities, buckled pavements, and structurally damaged some famous historical buildings. Endogenic or natural subsidence is related to processes that originate within the earth, including most of the tectonic processes. Exogenic subsidence is related to processes that originate near the earth's surface as a result of human activities such as fluid extraction and mining, and as a result of conditions such as loading and hydrocompaction. Rates of exogenic subsidence may exceed 50 cm/yr. A dramatic increase in subsidence in Venice can be dated from 1950 when great quantities of groundwater were pumped from the nearby mainland to meet industrial demands. London is sinking as the clay upon which it is built dewaters and compacts. This process is caused by groundwater being pumped from the chalk aquifer immediately below the clay. In Mexico City, a high differential subsidence is causing problems with structures and sewers. Groundwater withdrawal has also caused subsidence problems in Tokyo, Osaka, and Shanghai. Subsidence areas in the United States include Houston-Galveston, the San Joaquin Valley, Long Beach and Los Angeles, California, and New Orleans. Even though rapid subsidence in many cities appears to be arrested over the last 50 yr, there is no indication of ground elevation. Rises in sea level may be aggravated by increased use of fossil fuels and melting of polar ice. (Geiger-PTT)
W86-05321

ANALYSIS OF FLOW TO A LARGE-DIAMETER WELL DURING THE RECOVERY PERIOD,
Roorkee Univ. (India). School of Hydrology.
G. C. Mishra, and A. G. Chachadi.
Ground Water GRWAAP, Vol. 23, No. 5, p 646-651, September-October 1985. 6 fig, 5 tab, 7 ref.

Descriptors: *Wells, *Aquifer characteristics, *Pumping tests, Groundwater, Drawdown, Transmissivity, Storage coefficient, Groundwater recharge, Groundwater storage, Mathematical models.

A discrete kernal approach was developed to analyze drawdown at the well face during recovery of a large diameter well in a confined aquifier. Long duration pumping tests can be used to reveal aquifier characteristics in small diameter wells, but are not practical in large diameter wells. Using the new approach, pump test recovery data can be employed to reveal such aquifer parameters as transmissivity and storatge coefficient. The amount of error in the calculation of drawdown depends critically on the choice of measurement time steps (expressed as a fraction of a day). A procedure for selecting an appropriate time step is presented. Families of type curves, representing the variation of well function with pumping time for various storage coefficient/well dimension relationships, are matched to pump test data to yield aquifier parameters. The new approach offers an alternative to numerical methods for the analysis of flow to a large diameter well. (Robinson-PTT)
W86-05401

4C. Effects On Water Of Man's Non-Water Activities

INGENUITY SOLVES THE CITY'S DRAINAGE AND RECREATIONAL SPACE NEEDS,
For primary bibliographic entry see Field 4A.
W86-04737

FLOODS IN BRITAIN'S BASEMENT; INDUSTRY'S DEMAND FOR WATER IS PLUMMETING. AS A RESULT, RISING GROUND WATER THREATENS TUNNELS AND DEEP FOUNDATIONS IN MANY CITIES,
T. Nield.
New Scientist, Vol. 109, No. 1501, p 26-29, March 27, 1986.

Descriptors: *Water table, *Groundwater level, *Floods, England, London, Birmingham, Liverpool, Thames River, Lea Aquifer, Groundwater recharge, Aquifers, Piles, Pumping, Tunnels.

As factories close because of Britain's recession, water tables have risen. Floods have halted trains in Liverpool and forced the government's Property Services Agency to install pumps to keep a defence telecommunications link in Birmingham dry. In London, water engineers have been forced to shelve plans to create an underground reservoir for two years while researchers try to discover how higher water tables are likely to affect buildings. The foundations of structures such as Spaghetti Junction are threatened. The rising water table in London is affecting the Thames Water Authority's plan to recharge the Lea Aquifer under the Lea Valley. The piles of the new British Library are wider at the base to allow for corrosion when the water table rises in the future. Pumps in Liverpool extract ground water, preventing the railway tunnel from flooding. The water then flows to the Daily Post and Echo where it cools the presses. Now warm, it heats the offices of Royal Insurance before it is pumped into the Mersey. Because people now use water more efficiently, water tables will never sink to the depths they were immediately after the Second World War. (Peters-PTT)
W86-04969

STORM FLOW AND SEDIMENT LOSSES FROM SITE-PREPARED FORESTLAND IN EAST TEXAS,
Texas A and M Univ., College Station. Dept. of Range Science.
W. H. Blackburn, J. C. Wood, and M. G. DeHaven.
Water Resources Research WRERAO, Vol. 22, No. 5, p 776-784, May 1986. 2 fig, 6 tab, 21 ref.

Descriptors: *Storm flow, *Sediment loss, *Forest management, Clear-cutting, Cutting management, Forest watershed, Sediment erosion, Sediment transport, Texas.

Nine small (2.57 to 2.79 ha) forested watersheds in East Texas were instrumented in December 1979 to determine the effect of harvesting and site preparation on storm flow and sediment loss. Three replications of three treatments were used: 1) clear-cutting, followed by shearing, windrowing, and burning; 2) clearcutting, followed by roller chopping and burning; and, 3) undisturbed control. Prior to treatment, mineral soil was exposed on 3% of the watersheds. Following treatment in June 1981, 57% of the mineral soil was exposed on the sheared and windrowed watersheds compared to 16% on the chopped watersheds. At the end of the second, third, and fourth years' growing season, mineral soil was exposed on 20.9, and 10% of the sheared and 4, 4, and 3% of the chopped watersheds, respectively. The first year following treatment, mean storm flow was greater from the sheared watersheds (14.6 cm) than from the chopped (8.3 cm) watersheds, with the storm flow from the latter greater than from the undisturbed (2.6 cm) watersheds. During the third posttreatment year there was no significant difference in mean storm flow from the sheared and chopped watersheds or from chopped and undisturbed watersheds. Storm flow during the fourth posttreatment year was greater from the sheared watersheds (6.1 cm) than from the chopped (3.5 cm) watersheds, which had greater stormflow than the undisturbed (1.4 cm) watersheds. Although sediment losses were significantly different between treatment, they were small and below Soil Conservation Service tolerable levels. Mean sediment concentrations and losses from the chopped and undisturbed watersheds were similar during the four posttreatment years. Sediment concentrations from the sheared watersheds were greater than from chopped or undisturbed watersheds during the four posttreatment years. However, concentrations the first year after treatment (2119 mg/L) were greatly reduced the second (167 mg/L), third (54 mg/L), and fourth year (331 mg/L). (Lantz-PTT)
W86-05224

MONITORING EFFECTS OF CATCHMENT MANAGEMENT PRACTICES ON PHOSPHORUS LOADS INTO THE EUTROPHIC PEEL-HARVEY ESTUARY, WESTERN AUSTRALIA,
Western Australia Dept. of Conservation and Environment, Perth.
For primary bibliographic entry see Field 5B.
W86-05357

4D. Watershed Protection

DETENTION PONDS: THE POSITIVE AND THE NEGATIVE,
Overman (W.C.) Associates, Virginia Beach, VA.
For primary bibliographic entry see Field 4A.
W86-04738

ANALYSIS OF STRATIGRAPHIC CONTROL ON RIVER BANK FAILURE,
Nigeria Univ., Nsukka. Dept. of Geology.
C. O. Okagbue, and T. K. S. Abam.
Engineering Geology, Vol. 22, No. 3, p 231-245, April 1986. 7 fig, 4 tab, 13 ref.

Descriptors: *Bank erosion, *Niger delta, *Slip circle model, *Nigeria, Sand, Clay, Stratigraphy, Recessional mechanisms, Soil engineering, Plant cover, Sedimentation, Mathematical model, Precipitation, Flooding.

Most of the rivers of the Niger Delta, Nigeria, flow through alluvial deposits whose general stratigraphy is that of cohesionless sand overlain by cohesive silty clay. Erosion and recession of the river banks have constituted a threat to many villages along the various creeks in the delta area. Analyses of the recessional mechanisms indicated that bank failure is initiated by a fluvial erosion of the lower cohesionless bank layer at a much faster

rate than the upper cohesive bank layer. This leads to the development of overhangs of the upper cohesive materials. The failure mechanism of the river bank is complex, ranging from slip failures in high banks to shearing and toppling failures in low banks. The use of the common slip circle model for stability evaluation appears to be adequate only for high banks. Results obtained for the low banks suggest that the use of this model of stability analyses for low banks may yield misleading results. The engineering properties of the soils, seasonal variation of precipitation and flooding, density of vegetation, and the balance between rates of sediment supply from failed materials and their removal from bank toe all appear to influence the rate of bank retreat. (Rochester-PTT)
W86-04748

EROSION AND SEDIMENT TRANSPORT MEASUREMENT: SYMPOSIUM.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2J.
W86-04843

STUDIES OF SEDIMENT PRODUCTION ON MOUNTAIN SLOPES,
Kyoto Univ. (Japan). Faculty of Agriculture.
H. Hiura, K. Murakami, and K. Ohte.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 257-266, 8 fig, 4 tab, 1 ref.

Descriptors: *Sediment transport, *Erosion, *Soil mechanics, *Landslides, *Mountains, *Slopes, Sediment yield, Kizu River, Japan, Sediment yield, Disasters, Mudflows, Typhoons, Typhoon Ise, Penetration tests.

Accurate estimation of the volume of sediment production on mountain slopes is required for erosion control and forestry conservation. In order to produce such estimates, penetration tests using a Doken-type penetration testing machine, and morphologic analysis of topographical maps have been undertaken. Interpretation and analysis of the results have revealed: (a) sediment production on mountain slopes is mainly due to sliding of the surface soil, and information on the depth of the surface soil is needed; (b) the results of the penetration tests have shown that the depth of N sub 10 = 10 roughly corresponds to the depth of the surface soil layer, and a morphologic analysis have indicated that the most important topographical factor influencing sediment production is the area/height distribution; and (d) the estimate of sediment volume based on the above results is 27,030 cu m/sq km. (See also W86-04843) (Author's abstract)
W86-04869

RATE OF EROSION PROCESSES ON EXPERIMENTAL AREAS IN THE MARCHIAZZA BASIN (NORTHWESTERN ITALY),
Consiglio Nazionale delle Ricerche, Turin (Italy). Ist. di Ricerca per la Protezione Idrogeologica nel Bacino Padano.
E. Caroni, and D. Tropeano.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 457-466, 1 fig, 7 tab.

Descriptors: *Erosion, *Slopes, *Slope erosion, Marchiazza Basin, Italy, Soil erosion, Freezing, Rainfall, Slope degradation, Rills, Thalwegs.

This paper deals with the results of a 3-year study on slope erosion. Systematic surveys were performed on seven experimental plots and two small basins. Freeze-thaw cycles appear to be a preliminary factor inducing soil erosion. The displacement of grains occurs due to the impact of raindrops. The eroded material moves downward to the rills and thalwegs, whence periodically it is removed by debris flow phenomena. Comparing the material carried away and rainfall, it was observed that the amount of erosion is related, in the first place, to maximum rainfall intensity and, in the second place, to duration of erosive rainfalls as well as total rainfall depths. In spring and late summer when heavy rainstorms often occur, slope erosion is very intense and 60-80% of the annual erosion occurs. The rate of erosion on bare soil was 6 mm per year, on grass it was 0.2 mm per year; no erosion was observed in wooded areas. (See also W86-04843) (Author's abstract)
W86-04888

RECENT DEVELOPMENTS IN THE EXPLANATION AND PREDICTION OF EROSION AND SEDIMENT YIELD.
International Association of Hydrological Sciences.
For primary bibliographic entry see Field 2J.
W86-04896

ANALYSIS OF SEDIMENT YIELD AND TRANSPORT DATA FOR EROSION CONTROL WORKS,
Public Works Research Inst., Tsukuba (Japan).
T. Mizuyama.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 177-182, 4 fig, 5 ref.

Descriptors: *Erosion control, *Dams, *Sedimentation, Erosion, Sediment discharge, Japan, Sediment yield, Reservoirs, Drainage area.

Erosion control dams have been constructed on mountain torrents in Japan for 100 years, but their purpose and methods of evaluation are now being questioned. Some available sediment data (including sediment discharge of debris flows, the sediment yield of individual storms, and the rates of sedimentation in reservoirs in Japan) are analysed to evaluate the purpose of erosion control in Japan. The relationship of sediment yield to the area of the drainage basin is made clear and the magnitude of catastrophic sediment discharge is estimated. Based on these data, the purposes of erosion control works can be established as follows: in a small basin to check a very rare catastrophic sediment discharge such as a debris flow with erosion control dams, and in a large basin to reduce the sediment discharge and to make it uniform with erosion control dams or retarding basins. (Seee also W86-04896) (Halterman - PTT)
W86-04915

EROSIONAL PROCESSES AND SEDIMENT YIELD IN THE UPPER OLDMAN RIVER BASIN, ALBERTA, CANADA,
Northwest Hdrualic Consultants Ltd., Edmonton (Alberta).
C. R. Neill, and J. D. Mollard.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 183-191, 7 fig, 1 tab, 6 ref.

Descriptors: *Erosion, *Sediment yield, *Runoff, Gully erosion, Wind erosion, Geologic erosion, Aerial photography, Rivers, Alberta, Canada, Oldman basin, Continental Divide, Rocky Mountains, Suspended sediments, Stream channels.

The upper Oldman basin descends eastward from the Continental Divide of the Continental Divide of the Rocky Mountains in southwest Alberta. Its 4000 sq km area can be divided into Mountains, Foothills, and High Plains. The sediment yield and the associated erosional processes are discussed. Suspended sediment yield averages 70 t/sq km/yr, but varies greatly from year to year. This compares with a range of 20-100 elsewhere in Alberta and 0-350 in Canada generally. Principal erosional features identified include stream channel instability, ravine erosion, grassland gullying, wind erosion, and gravity-induced mass movements. An assessment of information obtained from airphoto interpretation and field reconnaissance indicates that erosional features are generally local in extent and are not creating widespread distress, that most present erosion is associated with streams and rivers, and that a substantial part of this is of natural geologic origin. The main source of man-made erosion appears to arise from public roads and associated interferences with natural drainage. A potential for accelerated erosion appears to exist on grazing lands on substantial slopes. In the forest areas, erosion is minor compared to that in agricultural areas. (See also W86-04896) (Author's abstract)
W86-04916

MATHEMATICAL SIMULATION OF EROSION ON GRADED TERRACES,
Old Dominion Univ., Norfolk, VA. Dept. of Civil Engineering.
A. O. Akan, and S. C. Ezen.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 221-228, 6 fig, 1 tab, 12 ref.

Descriptors: *Mathematical models, *Simulation, *Erosion rates, Kinematic wave theory, Model studies, Sediment carrying capacity, Sediment transport, Overland flows, Channel flows, Erosion.

A physically-based mathematical model is developed to simulate flow on a graded terrace idealized as an erodible and pervious overland flow plane and a terrace channel. A nonlinear kinematic wave scheme is adopted for routing the water and the sediment discharges through the overland and the channel flows. The erosion and the sediment transport capacities, the erosion rate and the sediment concentration in the overland flow are interrelated through a closed form equation. The transport capacity of the channel is determined by using the unit stream power concept. A finite difference method is employed to solve the partial differential equations of the mathematical model. The model is verified by a set of observed data. (See also W86-04896) Author's abstract)
W86-04919

APPLICABILITY OF THE UNIVERSAL SOIL LOSS EQUATION IN MOUNTAIN WATERSHEDS IN SEMIARID AND HUMID REGIONS,
Centre for Water Resources, Madras (India).
S. Chinnamani, V. S. Venkata, and R. Sakthivadivel.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 229-237, 3 fig, 2 tab, 10 ref.

Descriptors: *Mountains, *Erosion rates, *Watersheds, Erosion, Watershed management, Erosion control, Soil erosion, Mathematical equations, Sediments, India, Bhavani Basin, Universal soil loss equation, Sediment transport, Humid areas, Samiarid lands.

The mountain watersheds of the Bhavani basin in south India (latitude 10 deg 55 min - 11 deg 45 min N and longitude 75 deg 30 min - 77 deg 45 min E) lie partly in humid and partly in semiarid climatic regions. Due to increased population growth, many of these watersheds are undergoing rapid land use changes, especially from forest to agriculture, and consequently heavy soil erosion is taking place. Planning for proper development of these watersheds requires estimates of soil loss due to land use change. An attempt is made to predict soil erosion using the Universal Soil Loss Equation and to ascertain the soil erosion rate due to land use change. The computed annual soil loss (t/ha) agrees fairly well with the observed soil loss data provided by pilot studies. The sediment delivery ratios worked out for some of these waersheds compare favorably with those obtained for humid and semiarid areas in other countries. It is concluded that scientific land management with mixed forest, rural and urban land use is the final answer for erosion control in the Bhavani Basin. (See also W86-04896) (Author's abstract)
W86-04920

DEVELOPMENT OF DRAINAGE NETWORKS,
Universidad Simon Bolivar, Caracas (Venezuela). Graduate Program in Hydrology and Water Resources.
J. R. Cordova, I. Rodriguez-Iturbe, and P. Vaca.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 239-249, 3 fig, 1 tab, 7 ref.

Descriptors: *Mathematical models, *Overland flow, *Drainage patterns, Model studies, Erosion, Drainage area, Sediment transport, Surface runoff, Horton's Laws.

An attempt is made to describe the genetic relationships involved in drainage network growth and differentiation. A two-dimensional mathematical model of water and sediment is implemented to describe both flow and soil movement over a hillslope of a given geometry resulting from an effective rainfall pattern. A concentration of flow is induced at the outlet with resulting erosion which propagates upslope. The model permits study of the patterns of growth of the drainage network. When the hillslope contains a random topographic field of elevations or a random field of critical shear stresses in soil properties (or both) the resulting growth upslope quickly develops into a branching structure which fulfills Horton's laws. (See also W86-04896) (Author's abstract)
W86-04921

SOIL EROSION AND AGRICULTURE IN THE WORLD: AN ASSESSMENT AND HYDROLOGICAL IMPLICATIONS,
Moscow State Univ. (USSR). Dept. of Hydrology.
G. N. Golubev.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 261-268, 4 fig, 1 tab, 9 ref.

Descriptors: *Soil erosion, *Sediment transport, *Agricultural watersheds, *Model studies, Cultivated lands, Erosion, Mathematical models, Phosphorus.

Data from various areas of the world show that ploughing of virgin lands creates a drastic increase in water erosion of soils. On the average, it can be assumed that after transformation of forest into cropland, soil erosion increases by two orders of magnitude and for unforested territories the increase is of one order of magnitude. A special methodology was developed to assess the level of soil erosion in different landscapes and in the world as a whole for pre-agricultural time, the present, and the situation when (and if) all suitable land resources would be transformed into cropland. Both the methodology and the results are discussed. The results indicate that soil erosion in the world now is five times more than in pre-agricultural time and could be ten times more if all suitable lands are ploughed. The increased soil erosion leads to an increase in river sediment transport as well as accumulation of the eroded material in river networks. The problem of modification of chemical cycles (the phosphorus cycle in particular) as related to agricultural erosion is also discussed. (See also W86-04896) (Author's abstract)
W86-04923

ESTIMATION OF EXTREME SEDIMENT TRANSPORT FROM TORRENTIAL DRAINAGE BASINS IN THE EAST ALPS,
Torrent and Avalanche Control Research Inst., Vienna (Austria).
G. Kronfellner-Kraus.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 269-273, 13 ref.

Descriptors: *Model studies, *Soil erosion, *Flooding, Mathematical models, Sediment yield, East Alps, Drainage area, Erosion rates, Hydrographs, Flood hydrographs, Landslides, Gully erosion, Bed load, Sediment load.

A knowledge of the dangers and possible damage caused by torrents is one of the most important preconditions of sensible land use planning. Torrent erosion and sediment yield here include the whole process of excessive erosion (soil erosion, landslides, gully erosion) as well as bed load transport and deposition of bed load on debris cones or on valley floors. While our understanding of soil erosion has reached a high level, the quantitative estimation of torrent erosion and torrential sediment yields is much more difficult. Based on both special investigations in experimental drainage basins and the systematic sampling of data relating to all extreme events associated with torrents in the East Alps, general formulae for calculating extreme sediment yields from torrential drainage basins during floods and mud flows have been developed. These are discussed and compared with other procedures. (See also W86-04896) (Author's abstract)
W86-04924

HYDRODYNAMIC MODEL OF SEDIMENT TRANSPORT IN RILL FLOWS,
Mississippi Univ., University. Dept. of Civil Engineering.
S. N. Prasad, and V. P. Singh.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 293-301, 1 fig, 10 ref. NSF-CEE-81-19878.

Descriptors: *Erosion, *Mathematical equations, *Sediment transport, *Cultivated lands, Soil erosion, Rill erosion, Rills, Runoff, Flow.

Essentially all of the sediment lost from intensively cropped land during rainstorms is transported by runoff along row furrows, rills and other flow concentrations. The rate of sediment transport for such conditions depends on the rate at which the sediment is eroded from the interrill areas to the concentrated flows, the size and density of the sediment and hydrodynamic characteristics of the flow channels. A detailed hydrodynamic analysis of the flow of sediment in such furrows is presented. Emphasis is placed on the transport mode in the form of a densely packed moving layer near the bottom of the channel. Governing equations for the thickness of the bed layer are derived which are based upon the results of some recent studies pertaining to the constitutive laws for stress and deformation rate of granular materials. (See also W86-04896) (Halterman - PTT)
W86-04926

PREDICTION OF SEDIMENT YIELD FOR MOUNTAINOUS BASINS IN COLUMBIA, SOUTH AMERICA,
Rijkswaterstaat, Arnhem (Netherlands). Directorate for Water Management and Hydraulic Research.
W. E. van Vuuren.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 313-325, 3 fig, 1 tab, 7 ref.

Descriptors: *Sediment yield, *Mathematical equations, *Rivers, Mountains, Basins, Columbia, South America, Sediment transport, Universal Soil Loss Equation, Rio Cauca.

The Universal Soil Loss Equation is tested for prediction of the sediment yield of the Rio Cauca (in Columbia, South America). An attempt is made to develop a procedure for estimation of sediment yield on the basis of basin characteristics rather than by measuring sediment transport in streams. Computed basin soil loss is shown to be sensitive to the method of handling spatially distributed data on basin characteristics. Universal Soil Loss Equation procedures are found inadequate for extreme topographic and vegetational conditions, while it is probable that vegetation types are more dense than USA equivalents. Possibly due to this, computed soil loss greatly overestimates sediment yield calculated from limited transport data. Additional information about soil loss determination and measured transport is required for deciding whether soil loss is a good estimate for sediment yield in the area or that sedimentation on the flood plains of tributaries produces unacceptable delivery ratios. Prediction of sedimentation rates in mountainous reservoirs does not suffer this problem. Good station independent correlation between annual erosivity and a monthly precipitation index is found. (See also W86-04896) (Author's abstract)
W86-04927

SEDIMENT AVAILABILITY AND THE PREDICTION OF STORM-PERIOD SEDIMENT YIELDS,
Exeter Univ. (England).
D. E. Walling, and B. W. Webb.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 327-337, 4 fig, 36 ref.

Descriptors: *Sediment yield, *Sediment discharge, *Drainage area, Basins, Suspended sediments, Sediment concentration, Storms, Model studies, Runoff, Hydrographs, Sediment transport, Erosion, Devon, England.

The form of the suspended sediment concentration/discharge relationship or rating curve for a drainage basin reflects the overall pattern of erosion and sediment delivery operating in the upstream area. As such it may prove useful in the development of a realistic model of storm-period sediment yield. Several workers have highlighted the existence of 'exhaustion effects' in the form of the relationship and an attempt has been made to evaluate the evidence for temporal variations in sediment availability. Detailed records of suspended sediment concentration provided by continuous recording turbidity sensors installed in several basins in Devon, United Kingdom, have been used to study this feature of basin response. The implications for the development of sediment yield models are discussed. (See also W86-04896) (Author's abstract)
W86-04928

TIMESCALES OF DENUDATION: THE LAKE-DRAINAGE BASIN APPROACH,
Coventry (Lanchester) Polytechnic (England). Dept. of Geography.
J. A. Dearing, I. D. L. Foster, and A. D. Simpson.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 351-360, 2 fig, 1 tab, 33 ref.

Descriptors: *Erosion, *Sedimentation, *Denudation, Drainage area, Lakes, Erosion rates, Environment, Sediment erosion, Catchment areas.

Two methods for estimating rates of denudation in two different areas were studied: first, a small drainage basin experiment which provides detailed solute and sediment budgets for a short time period; and secondly, an analysis of sediments from a lake below the monitored stream in order to establish erosion rates over the past 140 years and to relate them to environmental change. Results from the drainage basin indicate a total particulate denudation of approximately 70 kg/ha/yr, some 10% of total output. The lake sedimentation data suggest an annual loss from the basin of approximately 100 kg/ha. Explanations are presented for the discrepancies found in extrapolating data. Further studies are suggested to examine rates of particulate denudation in forested, cultivated and mined environments, and to observe environmental stabilization following disturbance on a relatively long timescale which may well occur at rates not measurable by the present short term monitoring scheme. (See also W86-04896) (Halterman - PTT)

W86-04930

HYDROLOGIC CHARACTERISTICS AND MODELLING OF A SMALL FORESTED CATCHMENT IN SOUTHEASTERN NEW SOUTH WALES. PRE-LOGGING CONDITION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
For primary bibliographic entry see Field 2E.
W86-05116

STORM FLOW AND SEDIMENT LOSSES FROM SITE-PREPARED FORESTLAND IN EAST TEXAS,
Texas A and M Univ., College Station. Dept. of Range Science.
For primary bibliographic entry see Field 4C.
W86-05224

MORPHOLOGIC EFFECTS OF CHANNELIZATION: THE CASE OF THE NEEBING-MCINTYRE FLOODWAY, THUNDER BAY, ONTARIO, CANADA,
Lakehead Univ., Thunder Bay (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 8B.
W86-05408

CHANNEL ADJUSTMENTS TO THE REMOVAL OF LOG STEPS: AN EXPERIMENT IN A MOUNTAIN STREAM,
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ. Forestry Sciences Lab.
B. H. Heede.
Environmental Management, Vol. 9, No. 5, p 427-432, September, 1985. 4 fig, 2 tab, 12 ref.

Descriptors: *Channel morphology, *Vegetation effects, Gravel bars, Mountain streams, Bed loads, Debris.

Fallen trees and their large debris often form log steps in small mountain streams, where they are incorporated into the hydraulic geometry. The hypothesis that these log steps take the place of gravel bars that otherwise would have been required for channel slope adjustment was tested. The streams are located in virgin mixed conifer forests and until the study began no human activity had interfered with the natural developments. All log steps were removed from the test stream and the fallen trees and branches. Five years later, 74% of all the removed logs had been replaced by gravel bars. In the control creek, the bars increased by only 18% and logs steps decreased by 9%. This proves the hypothesis that increased bedload movement was required to offset the loss of log steps. Implications are that streamside forests should be managed so that they can provide a steady supply of debris for channel stability. (Peters-PTT)
W86-05409

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

RADIOACTIVITY OF SPAS ON THE GREEK ISLAND IKARIA AND INFLUENCING FACTORS,
Democritus Nuclear Research Center, Athens (Greece).
For primary bibliographic entry see Field 2K.
W86-04691

DETERMINATION OF DICAMBA AND 2,4-D IN WATER AND SOIL BY ISOTOPE DILUTION GC/MS,
Acurex Corp., Mountain View, CA.
V. Lopez-Avila, P. Hirata, S. Kraska, and J. H. Taylor.
Journal of Agricultural and Food Chemistry JAFCAU, Vol. 34, No. 3, p 530-535, May/June 1986. 4 fig, 4 tab, 18 ref. EPA Contract No. 68-03-3100 and 68-03-3226.

Descriptors: *Pollutant identification, *Dicamba, *2,4-D, *Water pollution, *Soil contamination, *Isotope studies, Gas chromatography, Mass spectrometry, Water sampling, Water analysis.

An isotope dilution gas chromatography/mass spectrometry (GC/MS) technique for the analysis of low part per billion (ppb) concentrations of dicamba and 2,4-D in water and soil is described. Known amounts of stable-labeled isotopes such as dicamba d sub 3 and 2,4-D d sub 3 are spiked into each sample prior to extraction. Water samples are extracted with methylene chloride at pH < or = 1; soil samples are extracted with acetone-hexane at pH < or = 1. Analysis is performed by high-resolution GC/MS, with the mass spectrometer operated in the selected ion monitoring mode, following derivatization of extracts with pentafluorobenzyl bromide (PFBBr). Accuracy greater than 84% and precision better than 19% were demonstrated with spiked samples. This technique has been used successfully in the analysis of over 300 water and 300 soil samples. Detection limits of 0.1-1.0 ppb for waters and 1-10 ppb for soils were achieved by selected ion monitoring GC/MS. Although superior in terms of accuracy and precision, the SIM GC/MS technique developed here lacks the specificity of the full-scan mode since only selected ions are monitored. The lack of specificity, however, has turned out to be a significant advantage for quantitative work for several reasons: (1) it eliminates the cleanup step and allows concentration of reaction extracts to 0.2 mL even in the absence of silica gel cleanup. (2) Interfering peaks from reaction of PFBBr with itself or with acetone under the catalytic influence of K2CO3 are not detected since only certain ions are being monitored. (Lantz-PTT)
W86-04692

ENERGY DISPERSIVE XRFA OF SOLUTIONS CONTAINING FE AND TRACE AMOUNTS OF CO AND OTHER HEAVY METALS AFTER SELECTIVE SEPARATION ON THE CELLULOSE EXCHANGER HYPHAN,
Technische Hochschule Darmstadt (Germany, F.R.). Fachbereich Anorganische Chemie und Kernchemie.
P. P. Coetzee, and K. H. Lieser.
Fresenius Zeitschrift fur Analytische Chemie, Vol. 323, No. 3, p 257-260, February 1, 1986. 1 fig, 2 tab, 10 ref.

Descriptors: *Energy-dispersive x-ray fluorescence analysis, *Iron, *Cobalt, *Cellulose exchanger, *Hyphan, *Iron interference, *Water analysis, Rain, Municipal water, Chemical analysis.

The elimination of FeKsubalpha interference in the determination of cobalt by energy dispersive x-ray fluorescence analysis (XRFA) was investigated. Two procedures were compared: (1) elution of iron from cellulose Hyphan filter used for the preconcentration of metal ions from solution prior to XRF analysis; cobalt is not eluted and can be subsequently determined free from interference, and (2) selective prevention of the sorption of iron onto cellulose Hyphan filters by boiling the analytical solution in the presence of 1% H202 before starting the sorption process. The methods were applied to the analysis of municipal water and rain water. The detection limit for cobalt is 0.4 microgram/liter in the presence of up to 1 mg/liter iron. (Author's abstract-PTT)
W86-04706

PHOTOMETRIC DETERMINATION OF BORON IN GROUND- AND SURFACE WATER (PHOTOMETRISCHE BESTIMMUNG VON BOR IM GRUND- UND OBERFLACHENWASSER),
Trier Univ. (Germany, F.R.). Abt. fuer Anorganische und Analytische.
U. de la Chevallerie-Haaf, A. Meyer, and G. Henze.
Fresenius Zeitschrift fur Analytische Chemie, Vol. 323, No. 3, p 266-270, February 1, 1986. 4 fig, 1 tab, 36 ref.

Descriptors: *Pollutant identification, *Rosocyanin, *Boron, *Water analysis, *Curcumin, *Photometry, Extraction, 2-Ethyl-1,1-hexanediol, Methylisobutylketone, River water, Tap water, Mineral water.

The colored complex 'rosocyanin' which formed after reaction with curcumin, is suited for the photometric determination of boron in water. An optimized procedure is described, which is superior to the usually applied standard method. Boron is separated from interfering matrix components in ground- and surface water by extraction with 2-ethyl-1,3-hexanediol in methylisobutylketone. Another advantage, in comparison with other methods, is the immediate formation of the curcumin complex in the extraction phase. For the determination of 1 ppb boron, the relative standard deviation was calculated to + or - 4.3%, for 100 ppb to + or - 11.1%. The boron contents of tap water, mineral water, and river water of different origins were investigated. Reference measurements were carried out using emissions spectrometry with ICP excitation. (Author's abstract)
W86-04707

GAS-CHROMATOGRAPHIC ELEMENTAL ANALYSIS VIA DI(TRIFLUORETHYL)DITHIOCARBAMATO CHELATES IX. OPTIMIZATION OF THE CAPILLARY-GAS-CHROMATOGRAPHIC DETERMINATION OF TRACE METALS,
Mainz Univ. (Germany, F.R.). Inst. fuer Kernchemie.
H. Schaller, and R. Neeb.
Fresenius Zeistschrift fur Analytische Chemie, Vol. 323, No. 5, p 473-476, March 1, 1986. 6 fig, 11 ref.

Descriptors: *Pollutant identification, *Trace metals, *Gas chromatography, *Chelates, *Di(trifluorethyl) dithiocarbamato-chelates, *Water analysis, Zinc, Copper, Nickel, Cadmium, Palladium, Cobalt, Iron, Lead, Chromium, Chemical analysis.

The capillary-gas-chromatographic conditions for the determination of trace metals after extraction from aqueous solutions are optimized by coupling of capillaries and improvement of injection technique. Different detectors (FID and ECD) were tested, and pH range and buffer systems for extraction of metal chelates are discussed. Among the metals involved in analyses were Zn, Cu, Ni, Cd, Pd, Co, Fe, Pb, and Cr. Analysis of aqueous solutions at the ppt level appears to be possible with an ECD. The reproducibility of the FID used here proved to be better than the ECD. Work with ECD is much more complicated than with the FID, and requires careful optimization of detector operation parameters. (Rochester-PTT)
W86-04708

SCREENING COMPLEX HAZARDOUS WASTES FOR MUTAGENIC ACTIVITY USING A MODIFIED VERSION OF THE TLC/SALMONELLA ASSAY,
Health Effects Research Lab., Research Triangle Park, NC. Genetic Bioassay Branch.
V. S. Houk, and L. D. Claxton.
Mutation Research MUREAV, Vol. 169, No. 3, p 81-92, March 1986. 2 fig, 4 tab, 41 ref.

Descriptors: *Thin layer chromatography, *Ames assay, *Salmonella assay, *Hazardous wastes, *Mutagenicity, Bioassay, Nitrosamine, Heterocyclics, Polycyclic aromatic hydrocarbon, Antitumor agents, Alkylating agents.

Ten complex hazardous wastes were tested for mutagenic activity using a modified version of the thin-layer chromatography/Salmonella assay developed by Bjoerseth and others. Unadulterated hazardous wastes and selected hazardous waste extracts were fractionated on commercially available TLC plates, and mutagenicity testing was performed in situ by applying a single overlay of minimal growth agar, tester strain TA98 or TA100, and the optional metabolic activation

system directly onto the developed chromatogram. Seven of the 10 wastes (including tars, emulsions, sludges, and spent acids and caustics) demonstrated mutagenic activity when tested by this method. fourteen Salmonella mutagens, including heterocyclic, aromatic amines, alkylating agents, antitumor agents, a nitrosamine and nitroaromatic were tested also. Of these, 11/14 tested positive. The three compounds refractory to analysis including a polycyclic aromatic hydrocarbon and two volatiles. (Rochester-PTT)
W86-04709

GAS CHROMATOGRAPHIC EVALUATION OF THE ORGANIC COMPONENTS PRESENT IN THE ATMOSPHERE AT TRACE LEVELS WITH THE AID OF CARBOPACK B FOR PRE-CONCENTRATION OF THE SAMPLE,
Consiglio Nazionale delle Ricerche, Rome (Italy). Ist. Inquinamento Atmosferico.
P. Ciccioli, E. Brancaleoni, A. Cecinato, C. DiPalo, and A. Brachetti.
Journal of Chromatography, Vol. 351, No. 3, p 433-449, January 31, 1986. 9 fig, 2 tab, 14 ref.

Descriptors: *Pollutant identification, *Gas chromatography, *Adsorbents, *Carbopack B, Tenax GC, *Organic compounds, *Air pollution, *Rain, Nitrous oxide, Oxidants, Acids, Diesel engine exhaust, Simulated atmospheres, Hydrocarbons, Chemical analysis, Water analysis, Sampling.

Enrichment on traps packed with Carbopack B adsorbent is proposed as a suitable method for the evaluation of organic compounds present at parts per 10(9)-10(12) levels in atmospheric samples. The technique has been applied to the determination of organics, dispersed in a suburban atmosphere, dissolved in rain water, or volatilized from the particulate matter emitted from an industrial emission and a diesel engine exhaust. A comparison between the efficiencies of Carbopack B and Tenax GC in the sampling of C6-C10 hydrocarbons, conducted with both simulated and natural atmospheres, indicates that Carbopack B is more efficient and does not give rise to sampling artifacts in the presence of oxidants and acidic pollutants, which are shown to cause decomposition of the Tenax GC polymeric matrix. The chemical inertness of Carbopack B also permits the determination of organic compounds in antropogenic emissions, where large amounts of NO2, water, and strong acids are present. (Author's abstract)
W86-04710

BROMINATION AND GAS CHROMATOGRAPHIC DETERMINATION OF MICRO AMOUNTS OF ACROLEIN IN RAIN WATER,
Gifu Prefecture Research Inst. for Environmental Pollution, Yabuta (Japan).
H. Nishikawa, T. Hayakawa, and S. Ikeda.
Journal of Chromatography, Vol. 351, No. 3, p 566-570, January 31, 1986. 2 fig, 4 tab, 11 ref.

Descriptors: *Pollutant identification, *Gas chromatography, *Acrolein, *Bromination, *Rain, Chemical analysis, Electron-capture detection, Air pollution.

The best condition for extracting the brominated derivative of acrolein from rain water was investigated, and a method was established for the determination of acrolein in rain water based on bromination followed by gas chromatography with electron-capture detection. This method permits the sensitive and selective detection of 4-200 nanogram/ml of acrolein in rain water without interference from related compounds. Total time required to conduct the analysis was about 80 min. (Rochester-PTT)
W86-04711

COMPARISON OF DIRECT HEADSPACE AND AQUEOUS INJECTION TECHNIQUES FOR HALOGENATED HYDROCARBONS IN WATER,
Florida International Univ., Miami. Drinking Water Quality Research Center.
M. Mehran, W. J. Cooper, M. Mehran, and W. Jennings.
Journal of Chromatographic Science JCHSBZ, Vol. 24, No. 4, p 142-146, April 1986. 5 fig, 1 tab, 10 ref. USEPA Grant R-811473-01-0.

Descriptors: Description: *Pollutant identification, *Gas Chromatography, *Halogenated hydrocarbons, *Water analysis, *Headspace injections, *Direct aqueous injections, Phase ratio focus, Cold trap, Model system, Apolar columns, Retention gap, Distribution constant focus.

Gas chromatographic methods for detection of volatile hydrocarbons in water are described and compared in which direct headspace injection and direct water injection into fused silica capillary columns are employed. Both the separation of components and the sensitivity of their detection are affected by the lengths of the chromatographing solute bands; factors that affect the lengths of those bands are defined. A model system, composed of deionized water containing trace amounts of 16 halocarbons was used for comparison of the methods. Two methods for focusing the headspace sample band following injection also were compared. Direct aqueous injections onto thick film apolar columns offer a simple method for the detection of many purgeable pollutants in water. Headspace injections, using a method that permits deposition of a vapor sample directly inside the fused silica column, yield improved sensitivity. Sensitivity and resolution are further enhanced when the injected band is focused prior to beginning the chromatographic process. A 'phase ratio focus,' employing an ultra-thick film column preceded by a section of uncoated tubing (retention gap) requires no cold trap. However, increased sensitivity results when a suitable cold trap is used to generate a 'distribution constant focus.' (Rochester-PTT)
W86-04712

DETERMINATION OF LINEAR ALKYLBENZENESULFONATES IN SEWAGE SLUDGE BY HIGH-RESOLUTION GAS CHROMATOGRAPHY/MASS SPECTROMETRY,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
J. McEvoy, and W. Giger.
Environmental Science and Technology ESTHAG, Vol. 20, No. 4, p 376-383, April 1986. 7 fig, 2 tab, 41 ref.

Descriptors: *Linear alkylbenzenesulfonates, *Sludge, *Particulate matter, *Biodegradation, *Gas chromatography, *Mass spectrometry, Wastewater treatment, Aqueous phase.

Linear alkylbenzenesulfonates (LAS) were identified and quantitatively determined in anaerobically and aerobically stabilized sewage sludges. The analyses were accomplished by the formation of the sulfonyl chlorides and subsequent high-resolution gas chromatography (HRGC) and flame ionization detection and directly coupled mass spectrometry (HRGC/MS) employing both electron impact and chemical ionization modes. The total LAS concentrations ranged from 0.3 to 1.2% of dry sludge, with only minor variations in the relative composition of LAS homologues and isomers. These concentrations are considerably larger than those of other pollutants that have been reported in sewage sludges. Although LAS are soluble in water, sorption of these amphiphilic chemicals onto suspended particles in sewage appears to be significant. In contrast to their biodegradability in the aqueous phase, LAS seem to be resistant to biodegradation during sludge treatment. (Author's abstract)
W86-04721

MEASUREMENT OF THE WATER-OCTANOL PARTITION COEFFICIENT OF 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN,
Syntex Research, Inc., Palo Alto, CA.
L. Marple, B. Berridge, and L. Throop.
Environmental Science and Technology ESTHAG, Vol. 20, No. 4, p 397-399, April 1986. 2 tab, 12 ref.

Descriptors: *Dioxin, *Water-octanol partition coefficient, *Chemical analysis, Shake flask method.

The problem inherent in the 'shake flask' method for measurement of water-octanol partition coefficients were avoided by the use of a cell in which dioxin was allowed to diffuse from the octanol phase into the water phase. Starting from mutually presaturated water and octanol phases, dioxing equilipration appears to be complete within 1 wk. Partition coefficients ranged from 33.48 x 10(6) to 8.87 x 10(6). Starting from unsaturated phases, a rapid transport of dioxin was observed from the octanol phase into the water phase, followed by a reversal that corresponds to the formation of hydrated dioxin. The average of all partition coefficient measurements for systems at equilibrium is 4.24 + or - 2.73 x 10(6), giving a log K sub ow of 6.64. (Author's abstract)
W86-04722

OCCURRENCE OF CADMIUM IN CRABS (CANCER PAGURUS) AND THE ISOLATION AND PROPERTIES OF CADMIUM METALLOTHIONEIN,
Institute of Marine Biochemistry, Aberdeen (Scotland).
J. Overnell.
Environmental Health Perspectives EVHPAZ, Vol. 65, p 101-105, Marc 1986. 1 tab, 7 fig, 16 ref.

Descriptors: *Cadmium, *Crabs, *Amino acids, *Proteins, Chromatography, Metallothionein, Chemical analysis, Metals, Tissue analysis.

A method of purifying metallothionein from crab tissues avoids problems previously encountered. The method uses an initial batch absorption on DEAE-cellulose followed by G-75 and DEAE-cellulose chromatography. Quantitative amino acid analysis of the purified protein suggests that it has a total of 55 residues, including 19 Cys, and a molecular weight of approximately 5800. This yields an extinction coefficient at 220 nanometers for the protein in HCl, pH 1.5, of 50,000 and at 250 nanometers for the native cadmium protein in Tris-HCl, pH 8.4, of 92,000. The other amino acids present in crab metallothionein include: Asp, Thr, Ser, Glu, Pro, Gly, Ala, and Lys. A total metal-to-protein ratio of 6 gram-atoms per mole was obtained. (Peters-PTT)
W86-04756

METAL-BINDING PROTEINS AS METAL POLLUTION INDICATORS,
National Research Inst. for Oceanology, Stellenbosch (South Africa).
For primary bibliographic entry see Field 5C.
W86-04763

FRESHWATER BIOLOGICAL MONITORING.
International Association on Water Pollution Research and Control, London (England).
Available from Pergamon Press, New York, NY. $35.00. Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. 1984. Edited by D. Pascoe and R. W. Edwards. 167 p.

Descriptors: *Biological monitoring, *Rivers, *Water pollution effects, Monitoring, Bioassays, Water sampling, Data analysis, Analysis, Water pollution, Invertebrates, Fish, Plants, Toxicity.

Biological monitoring of rivers and other natural waters, a long-established practice, traditionally utilizing the structural changes to natural communities which pollution induces, has only recently responded to the opportunities afforded by developments in such fields as sampling methodology, physiological and bioassay procedures, and data analysis. This seminar explores the interpretation of traditional community surveillance studies through the application of the modern computer and multivariate statistical techniques; it also tries to relate such field community responses to laboratory studies of pollutants. Attention is given to the design, validation and use of novel monitoring systems employing plants, invertebrates and fish, and recent developments in the in vitro assessment of mutagenicity of chemicals present in water are discussed. (See W86-04768 thru W86-04783) (Lantz - PTT)

W86-04767

FRESHWATER BIOLOGICAL MONITORING: KEYNOTE ADDRESS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
J. Cairns.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. New York, 1984. p 1-14, 23 ref.

Descriptors: *Monitoring, *Water pollution, *Water pollution effects, *Toxicity, Assimilative capacity, Application factors, Regulatory standards, Regulations.

The field of biological monitoring has advanced quite rapidly in the past 20 years. However, fuller use of existing methodology is hampered by doubts in both industrial and regulatory agencies regarding both the precision of the tests and the ways in which the information will be used. Factors which should be considered when using the tests to predict the capability of any quality control system, are: (1) reliability of extrapolations from test systems to natural systems, (2) interpretation of test data, (3) sensitivity, with respect to avoiding false negative responses, (4) variability, and (5) replicability of testing methods and results. However, none of these factors present insurmountable problems for biological monitoring, but rather necessitate the need for sound scientific judgement when evaluating the monitoring data. (See also W86-04767) (Lantz - PTT)
W86-04768

PERFORMANCE OF AN INVERTEBRATE COLONISATION SAMPLER (S. AUF.U.) IN BIOLOGICAL SURVEILLANCE OF LOWLAND RIVERS,
Aston Univ., Birmingham (England).
A. J. Watton, and H. A. Hawkes.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. New York, 1984. p 15-24, 4 tab, 40 ref.

Descriptors: *Monitoring, *Biological samples, *Biological monitoring, *Rivers, Sampling, Macroinvertebrates, Gammaridae, Asellus aquaticus, Potamopyrgus Potomopyrgus jenkinsi, Polycentropidae, Biotic indices, Water pollution.

The objective of this investigation was to assess the usefulness of the colonisation sampler (S.Auf.U) in collecting macro-invertebrates indicative of river water quality in lowland rivers which have proved difficult to monitor by direct biological sampling methods. The validity of applying different biotic and diversity indices was also examined. S.Auf.U. were immersed for one month periods at 24 sites on 14 different rivers for which regular physiochemical data were available from the respective Water Authorities. The macro-invertebrate species and their relative abundance collected on the S.Auf.U. from the different sites were clearly related to the water quality. Heavy metal pollution was reflected by a reduction in the numbers of Gastropods and bivalve molluscs. Increasing organic pollution was reflected by a decline in the Gammarus/Asellus ratio and by a reduction in numbers of Potamopyrgus jenkinsi and the Polycentropidae. The numbers of Erpobdellidae increased with increasing organic pollution. None of six indices calculated adequately represented these differences in macro-invertebrate assemblages over the whole range of water quality. It is concluded that colonisation samplers could be used to advantage in water quality monitoring in lowland rivers. However indices currently in use are not appropriate for presenting the data. Instead it is recommended that the data be summarized in the form of a taxa-relative abundance list based on 18 taxa. (See also W86-04767) (Author's abstract)
W86-04769

BIOLOGICAL SURVEILLANCE IN WELSH RIVERS FOR WATER QUALITY AND CONSERVATION ASSESSMENT,
Welsh Water Authority, Gwent. Nash Area Lab.
M. P. Brooker.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. New York, 1984. p 25-33, 4 fig, 1 tab, 24 ref.

Descriptors: *Monitoring, *Biological monitoring, *Water quality standards, *Water conservation, *Rivers, Macroinvertebrates, Statistical analysis, Multivariate analysis, Water pollution, Wales.

Studies of macroinvertebrates in several Welsh rivers are examined to assess needs of sampling, identification and data analysis in relation to biological assessment of water quality and conservation evaluation. Because of the costs of sampling and processing the identification of redundant information in biological collections is an important procedure. The restriction of sampling to one habitat type (e.g. riffles) and the omission of taxonomically difficult groups had no major effects on the establishment of spatial patterns relevant to water quality assessment in a number of Welsh rivers. However, preliminary conclusions from a single river catchment indicate that conservation evaluation requires collections from at least three habitat types (eroding, depositing and vegetation) and detailed taxonomic information. Biotic indices, many based upon empirical assessment of macroinvertebrate distributions, principally in relation to organic pollution, have been widely used to assess water quality. Some of the relatively more complex indices based upon detailed taxonomy and semi-quantitative data (e.g. Chandler score) are not demonstrably better than the simple BMWP score, which is based upon the presence/absence of family groups. Multivariate techniques are increasingly being used to identify causal relationships between river macroinvertebrates and specific changes in water quality so leading to a greater understanding of species tolerances. In particular the application of classification techniques, based upon correlation and similarity coefficients and reciprocal averaging (TWINSPAN), to collections from several Welsh rivers is considered. (See also W86-04767) (Author's abstract)
W86-04770

INVERTEBRATE DRIFT IN THE BIOLOGICAL MONITORING OF WATER QUALITY,
National Inst. for Water Research, Pretoria (South Africa).
F. M. Chutter.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. New York, 1984. p 35-44, 8 fig, 3 tab, 14 ref.

Descriptors: *Rivers, *Running waters, *Benthos, *Water pollution, *Monitoring, Biological monitoring, Biotic index, Nitrogen, Biological oxygen demand, Phosphorus, Chironomidae, Exuviae, Water quality.

Water chemistry, benthos and drift were monitored simultaneously at seven sites over 60 km below a sewage works outfall in a fast-flowing river. Objectives were to record both the living and exuvial drift along the course of the river and to test a previously described biotic index of water quality based on the benthos. All sampling was undertaken between 09h00 and 15h30 during the dry winter season. Biotic index values correlated significantly ($P<0.01$) with total nitrogen and total phosphorus concentration and with five-day biochemical oxygen demand of the water. Drift density increased with rising water temperatures. There were marked changes in the composition of the drift, particularly among the Chironomid pupae, along the course of the river. The biotic index is a useful measure of water quality, but drift density is not useful in this way. However, drift composition has considerable potential, which will only be realized when drift variation following water quality is known from more rivers and when the taxonomy of Chironomid pupae is further advanced. (See also W86-04767) (Author's abstract)
W86-04771

EARLY WARNING OF EUTROPHICATION IN RIVERS BY ANALYSIS OF PERIPHYTON CHLOROPHYLL A,
National Board of Waters, Helsinki (Finland). Water Research Inst.
P. Heinonen.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. New York, 1984. p 45-52, 3 fig, 1 tab, 8 ref.

Descriptors: *Rivers, *Eutrophication, *Periphyton, *Chlorophyll a, *Biological monitoring, Fish farming, Phosphorus, Nitrogen, Water quality.

Detection of the early stages of eutrophication in running waters is very difficult. Problematic situations have arisen particularly in waters downstream of fish breeding stations. Fish farms are usually of necessity situated in the course of unpolluted, oligotrophic rivers or running waters in lake chains, but are themselves considerable sources of nutrient loading and eutrophication. An investigation was carried out of a watercourse (MQ - 43 cu m/s) eutrophication, resulting from the activities of a fish breeding station producing about 180, 000 kg of rainbow trout annually. Eutrophication due to the phosphorus and nitrogen loading from this plant reduced the value of the watercourse. Natural reproduction of trout ceased almost completely and the possibilities of recreational utilization of the watercourse decreased. Standard physical-chemical analysis of water samples taken from above and below the fish farm did not reveal any statistically significant differences between water quality variables. Periphyton was investigated by incubating artificial growth plates in the river for three weeks and analyzing periphyton chlorophyll a. The eutrophying effects of the fish breeding station were clearly demonstrated by this method. Differences between the upstream and downstream amounts of periphyton on the growth plates were statistically highly significant. (See also W86-04767) (Author's abstract)
W86-04772

INVESTIGATIONS INTO THE CAUSES OF FISH KILLS OCCURRING IN THE RIVER MEUSE (1979-1983),
Antwerpse Waterwerken (Belgium).
For primary bibliographic entry see Field 5C.
W86-04773

ASPECTS OF UTILIZING CONTINUOUS AUTOMATIC FISH BIOMONITORING SYSTEMS FOR INDUSTRIAL EFFLUENT CONTROL,
National Inst. for Water Research, Pretoria (South Africa).
W. S. G. Morgan, and P. C. Kuhn.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. New York, 1984. p 65-73, 6 fig, 10 ref.

Descriptors: *Biological monitoring, *Monitoring, *Water pollution control, *Automation, *Industrial wastes, *Effluents, Toxicity, Fish physiology, Wastewater, Wastewater pollution.

Automated biological monitoring systems, employing pre-mortal symptoms in fish as an indication of insidious toxic conditions, have been developed to prevent hazardous industrial discharges from deleteriously affecting freshwater ecosystems. The parameters used to detect the occurence in wastewaters of situations toxic to fish have been opercular movement, monitored by processing the signal which arises as a result of a change in potential between stainless steel electrodes caused by ventilatory movements, and locomotory activity, monitored by means of ultrasonic echoes. Laboratory investigations have been conducted on the capability of such systems to detect acute, sublethal and chronic levels of intoxication; the effect of longterm exposure to very low toxicant concentrations on fish sensitivity; the effect of ambient temperature on the parameters employed and the adequacy of the statistics used to establish hazard detection levels. The results of such investigations have enabled researchers to define the problems

associated with the incorporation of biomonitoring systems into industrial effluent control complexes. (See also W86-04767) (Author's abstract)
W86-04774

AUTOMATED MULTISPECIES BIOMONITORING EMPLOYING FISH AND AQUATIC INVERTEBRATES OF VARIOUS TROPHIC LEVELS,
Tennessee Technological Univ., Cookeville.
E. L. Morgan, R. C. Young, and C. M. Crane.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. New York, 1984. p 75-80, 1 fig, 11 ref.

Descriptors: *Biological monitoring, *Monitoring, *Water quality, *Trophic levels, Invertebrates, Computers, Bluegills, Mussels, Mayflies, Computer programs, Toxicity, Water pollution.

Automated biomonitoring may provide real-time insight into cause/effect relationships between developing toxicity and a representative aquatic animal, usually fish. However, since the applicability of single-species biomonitoring information may be subject to question when viewed in light of community toxicity and ecological quality control programs, the authors developed a computer-assisted multiple species biosensing system for stream-side water quality monitoring. In addition to using bluegill, emphasis was placed on refining techniques for detecting species-specific bioelectric responses produced by unrestrainted mussels, burrowing mayfly nymph (Hexagenia spp.) and preliminary work with caddis fly larva case builders. A specially designed differential amplifier was used for measuring bioelectric responses induced from specific movement activities generated by each test subject. Selected responses were detected as discrete analog signals, digitized and filed on disk. A management program provided various means for data gathering, filing and retrieval. Two pilot biomonitors were developed, each consisting of a 16-bit instrumentation minicomputer with hardcopy and modum outputs. These systems coupled to an IBM-PC based biomonitor having multichannel biosensor and physical parameter inputs, complete the present network. (See also W86-04767) (Author's abstract)
W86-04775

TOXICITY TESTING WITH FRESHWATER MACROINVERTEBRATES: METHODS AND APPLICATION IN ENVIRONMENTAL MANAGEMENT,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
K. Williams, D. Green, and D. Pascoe.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. New York, 1984. p 81-91, 5 fig, 2 tab, 27 ref. Contract ENV.484.81.UK.14.

Descriptors: *Toxicity, *Macroinvertebrates, *Environmental policy, *Monitoring, Biological monitoring, Water pollution, Water quality, Water pollution effects.

The importance of using freshwater macroinvertebrates in toxicity tests is discussed. Existing test methods are examined in relation to their potential in evaluating the environamental effects of the release of toxic substances. The role of laboratory test data in explaining known distribution patterns of macroinvertebrates in the field is considered with reference to specific examples. A systematic scheme of data generation for the derivation of water quality criteria is presented with respect to the compatibility between the choice of test design, test species and appropriate measurement of response. (See also W86-04767) (Author's abstract)
W86-04776

PREDICTION OF THE TOXICITY OF COPPER TO AUSTRALIAN FRESHWATER ANIMALS,
New South Wales Inst. of Tech., Broadway (Australia).
For primary bibliographic entry see Field 5C.
W86-04777

COMPARISON OF BIOMONITORING TECHNIQUES FOR EVALUATING EFFECTS OF JET FUEL ON BLUEGILL SUNFISH (LEPOMIS MACROCHIRUS),
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 5C.
W86-04778

LEMNA AS AN INDICATOR OF WATER POLLUTION AND THE ABSORPTION OF HEAVY METALS BY LEMNA,
Shinshu Univ., Matsumoto (Japan). Dept. of Public Health.
Y. Nasu, M. Kugimoto, O. Tanaka, and A. Takimoto.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. 1984. p 113-120, 11 fig, 1 tab, 8 ref.

Descriptors: *Biological monitoring, *Monitoring, *Lemna paucicostata, *Water pollution effects, *Bioindicators, Water pollution, Heavy metals, Cadmium, Zinc, Manganese, Arsenic, Absorption, Arsenic, Copper.

To determine the potential for use of Lemna paucicostata 6746 as an indicator of water pollution, and for its utilization as a purifier of waste water, and to study the biokinetics of heavy metals, the sensitivity of Lemna to heavy metals and the mode of metal absorption by Lemna were studied. The concentration factor of cadmium for Lemna was from approximately 100 to 500 at the 24th hour after the start of culture on Bonner-Devirian medium containing cadmium (pH6.1). Seven days after the start of culture, 70% of cadmium in 25 ml of medium was absorbed by Lemna on 0.01 ppm cadmium-containing medium, 50% on 0.1 ppm, and 2% on 1 ppm cadmium-containing medium. Those factors which make Lemna more sensitive to cadmium -- the high pH value of the medium, dilution of the medium, and high temperature -- were also effective in causing the rapid adsorption of cadmium by Lemna. The frond multiplication of Lemna for 7 days was inhibited 50% by 0.1 ppm of cadmium or copper, and by 1 ppm of zinc, manganese or arsenic. Arsenic and copper inhibited the growth of each frond more effectively than frond multiplication, whereas zinc, manganese and cadmium primarily inhibited frond multiplication. (See also W86-04767) (Author's abstract)
W86-04779

APPLICATION OF AN ALGAL ASSAY TO ASSESS TOXICITY AND EUTROPHICATION IN POLLUTED STREAMS,
Norsk Inst. for Vannforskning, Oslo.
For primary bibliographic entry see Field 5C.
W86-04780

MICROBIAL MUTAGENICITY TESTING OF WATER SAMPLES,
Water Research Centre, Marlow (England).
P. Wilcox, and H. Horth.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. 1984. p 131-141, 5 fig, 26 ref.

Descriptors: *Toxicity, *Carcinogens, *Water pollution, *Microbial studies, *Water sampling, Mutagenicity, Carcinogenicity, Salmonella typhimurium, Water pollution sources, Chlorination.

The use of microbial test systems for investigating the mutagenic activity of water samples is discussed and the problems associated with testing complex environmental samples in such assays considered. A number of different experimental approaches which can be used to investigate the mutagenicity of water samples are summarised and illustrated by studies carried out at the Water Research Centre (WRC). Concentrated extracts of chlorinated drinking water samples derived from surface waters can be consistently shown to possess mutagenic activity in bacterial test systems. One source of these mutagenic chemicals appears to be the chlorination of naturally-occurring compounds in water, such as humic acids. The significance of these findings in relation to human health is, at present, unknown. (See also W86-04767) (Author's abstract)
W86-04781

BACILLUS SUBTILIS/MICROSOME REC-ASSAY FOR THE DETECTION OF MUTAGENS IN WATERS OF A MUNICIPAL WASTEWATER TREATMENT PLANT,
Kanazawa Univ. (Japan). Dept. of Construction and Environmental Engineering.
S. Matsui.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. 1984. p 143-152, 4 fig, 5 tab, 4 ref. Grant No. 57550328.

Descriptors: *Bioassays, *Water pollution effects, *Wastewater pollution, *Toxicity, Bacillus subtilis, Rec-assay, Dichloromethane, Probit theory, Target theory, Activated sludge, Mutagens.

A Bacillus subtilis/microsome rec-assay was improved by the introduction of a period for the test sample to interact with bacteria before cultivation in a Monod tube. During the interaction period the nutrient level is insufficient for the bacteria to duplicate their DNA. This method is called the liquid B. subtilis/microsome rec-assay stationary method. Evaluation of the rec-assay is presented in terms of R50, S-probit and RS, which were analyzed with computer programs developed on Probit theory and Target theory. Results could be classified into four categories: strong mutagenic, mutagenic, not mutagenic and reverse. One possible explanation for the 'reverse' effect is that the recombination repair enzyme system may be disrupted by test substances. Application of the rec-assay to water samples from a municipal wastewater treatment plant showed that effluents from both primary and secondary treatment contained mutagens and also substances giving the reverse effect. Both dichloromethane extraction and XAD-2 adsorption were useful for concentration and separation of mutagens and reverse effective substances from the water samples except for substances of low boiling point. It is likely that biological treatment is not effective for the removal of mutagens. (See also W86-04767) (Author's abstract)
W86-04782

COMPLIANCE BIOMONITORING - STANDARD DEVELOPMENT AND REGULATION ENFORCEMENT USING BIOMONITORING DATA,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
E. E. Herricks, and D. J. Schaeffer.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. 1984. p 153-166, 2 tab, 28 ref.

Descriptors: *Biological monitoring, *Water quality standards, *Water quality control, *Water quality management, Toxicity, Water sampling, Bioassays, Monitoring, Regulations, Standards.

The development and enforcement of chemical water quality standards has been the primary focus of water quality planning, management, and regulation. The typical water quality standard is driven by criteria developed from experimental analysis of biological effects. Recently, this indirect method of protecting aquatic life has been bypassed. Compliance biomonitoring has been encouraged as a method for application of biological standards to effluent monitoring and water quality enforcement. The selection of the biological parameter for which a standard will be developed as well as actually setting a standard of biological condition or performance have impeded the implementation of regulatory programs based on biomonitoring results. The use of biomonitoring data in regulatory activity requires data collection and analysis

procedures which must meet stringent tests of statistical reliability, interpretative strength, and regulatory efficiency. This paper reviews the requirements for implementation of compliance biomonitoring, evaluates several methods of data collection and analysis, and suggests a mechanism for selection of compliance measures from biomonitoring data. In contrast to conventional regulatory methods which evaluate standard using only single species toxicity testing or simplified microcosm/community analysis, the basis of our approach to compliance biomonitoring is analysis of hierarchies of biological organization and the reliability of measures available at each level. Emphasis is placed on sampling of systems which vary through space and time, determination of threaholds of effect, and requirements which must be met to assure maintenance of evidentiary standards for legal proceedings. (See also W86-04767) (Author's abstract)
W86-04783

CHEMICAL AND BIOLOGICAL CHARACTERIZATION OF BLACK ROCK HARBOR DREDGED MATERIAL,
Environmental Research Lab., Narragansett, RI.
P. F. Rogerson, S. C. Schimmel, and G. Hoffman.
Technical Report D-85-9, September 1985. Final Report. 123 p, 20 fig, 16 tab, 26 ref, 2 append.

Descriptors: *Dredging, *Chemical analysis, *Biological analysis, Organic compounds, Mytilus edulis, Blue mussel, Heavy metals, Copper, Nickel, Zinc, Chromium, Lead, Cadmium, Mercury, Black Rock Harbor, Bridgeport, Connecticut.

Black Rock Harbor, Bridgeport, Conn., dredged material contained substantial concentrations of both organic and inorganic contaminants, many of which were shown to be biologically available to the blue mussel, Mytilus edulis, in a laboratory bioassay. Tissue PCB concentrations were 44% of the concentration found in the sediment (6800 ng/g), while tissue concentrations of parent polynuclear hydrocarbons were 28% of sediment concentrations that ranged up to 9800 ng/g. Also present in the sediment were Cu, Cr, Zn, Pb, Ni, Cd, and Hg at 2380, 1430, 1200 380, 140, 23, and 1.7 micrograma/g, respectively. Of these, Cu, Cr, Pb, Ni, and Cd accumulated in the mussels. In acute solid phase toxicity tests, the sediment was lethal to only one of the eleven species tested, Ampelisca abdita, although behavioral changes were observed in two additional species, both infaunal species. No effect was noted with epibenthic or water column species in either solid phase or in combination with suspended particulate phase. This investigation is the first phase in developing field-verified bioassessment evaluations for the Corps of Engineers and the US Environmental Protection Agency regulatory program for dredged material disposal. This methodologies that are field verified will be available at the conclusion of this program. (Author's abstract)
W86-04937

CONFIRMATION OF THE WATER QUALITY MODEL CE-QUAL-R1 USING DATA FROM EAU GALLE RESERVOIR, WISCONSIN,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5B.
W86-04941

MODEL TO PREDICT BOD FROM COD VALUES,
Benin Univ., Benin City (Nigeria). Centre for Social, Cultural and Environmental Research.
C. M. A. Ademoroti.
Effluent and Water Treatment Journal, Vol. 26, No. 3/4, p 80-84, March/April 1986. 3 tab, 1 fig, 12 ref.

Descriptors: *Biochemical oxygen demand, *Chemical oxygen demand, *Wastewater, Domestic wastes, Poultry wastes, Animal wastes, Industrial wastewater, Brewery wastes, Mathematical analysis.

The BODs and the chemical COD values for domestic, poultry and brewery wastewaters were determined and their values compared. The domestic wastewater was from the University of Benin Teaching Hospital community in Benin City and the amount generated daily was estimated at 67,000 liters. The poultry wastewater was from a poultry farm stocking about 10,000 fowls on the outskirts of Benin city. The brewery wastewater was from a brewery in Benin. A linear relationship was established: COD = a time BOD plus b where a and b are constants. The values of a were 1.65, 1.45, and 2.32 for domestic, poultry, and brewery wastewaters respectively; and the corresponding b values were 11.36, 55.7, and 46.2 mg/l. The linear regression of COD values on the corresponding BOD values was positive and strongly related for the various wastewaters. The equation was found useful for predicting BOD from the corresponding COD values. (Peters-PTT)
W86-04951

TRACE METALS IN MUSSELS (MYTILUS EDULIS) FROM THE WADDENZEE, COASTAL NORTH SEA AND THE ESTUARIES OF EMS, WESTERN AND EASTERN SCHELDT,
Fish Technology Inst. TNO, Ijmuiden (Netherlands).
For primary bibliographic entry see Field 5C.
W86-04967

TIRE FIRE OIL: MONITORING A NEW ENVIRONMENTAL POLLUTANT,
Virginia Dept. of General Services, Richmond. Div. of Consolidated Lab. Services.
J. C. Peterson, D. F. Clark, and P. S. Sleevi.
Analytical Chemistry ANCHAM, Vol. 58, No. 1, p 70A-72A, 74A, January 1986. 4 fig, 2 tab.

Descriptors: *Tires, *Fire, *Oil pollution, *Monitoring, *Gas chromatography, *Toxicity, Runoff, Caprolactam, Benzothiazole derivatives, Benzoic acid, Benzamides, Aromatic polyamide fibers, Benzonitrile, Hydrocarbons.

To monitor the oil draining from beneath a burning pile of 5-7 million discarded tires flame ionization and thermionic specific detectors were employed with capillary gas chromatography in a dual, simultaneous detection set-up. In addition to the oil itself, water from streams contaminated by the oil flow was sampled. The pollutants found in the water were consistent with tire-manufacturing components, and included caprolactam, benzothiazole derivatives, benzoic acid, benzamides (likely degradation products of aromatic polyamide fibers), and benzonitrile (possibly formed by dehydration of benzamide). The ensemble of contaminants was highly toxic to all life in the stream as far as 1.1 km from the fire, but it is not known which of the compounds was responsible for the toxicity. The concentration levels of contaminants increased substantially downstream after rain, but the composition and relative proportions remained similar. (Rochester-PTT)
W86-04979

AUTOMATED ION CHROMATOGRAPHIC DETERMINATION OF ANIONS IN PRECIPITATION SAMPLES,
Geological Survey, Reston, VA.
G. S. Pyen, M. R. Brown, and D. E. Erdmann.
American Laboratory, Vol. 18, No. 5, p 22, 24, 26, 28, 30, 32, May 1986. 5 tab, 2 fig, 7 ref.

Descriptors: *Anions, *Chromatography, *Precipitation, Fluorides, Chlorides, Sulfates, Bromides, Halides, Phosphates, Nitrates, Chemical analysis.

The ion chromatographic technique is a rapid, precise, and accurate method for the determination of anions in precipitation samples. Detection limit of 0.01 milligrams/liter can be achieved without using a concentrator column. Ion chromatographic results for Cl, PO4-P, NO3-N, and SO4 were compared with values obtained by automated colorimetric and turbidimetric methods and showed good agreement for the low concentration ranges encountered. Since precipitation samples rarely contain measureable amounts of F, PO4-P, and Br, it was necessary to prepare synthetic precipitation samples to conduct comparison studies. Excellent agreement was obtained between ion chromatography and colorimetry for the PO4-P determination on six samples over the range of 0.01 to 0.50 milligrama/liter. A good comparison was also shown between ion chromatography and ion selective electrode for determination of F on four samples over the range of 0.02 to 0.05 milligrams/liter. (Peters-PTT)
W86-04984

FUSED SILICA OPEN TUBULAR COLUMN OPTIMIZED FOR THE ANALYSIS OF VOLATILE ORGANIC POLLUTANTS,
J and W Scientific.
R. R. Freeman, and R. M. A. Lautamo.
American Laboratory, Vol. 18, No. 5, p 60, 62-64, 66-68, May 1986. 7 fig, 9 ref.

Descriptors: *Organic wastes, *Chromatography, *Volatile pollutants, Megabore column, Chemical analysis, Drinking water, Industrial wastewater, Effluents, Benzenes, Aromatic compounds, Water quality standards.

A stationary phase has been synthesized for use with fused silica open tubular columns which can be readily cross-linked and surface-bonded to the silica. The selectivity of the phase has been optimized for the separation of volatile organic pollutants. When coated on large diameter tubing, the resulting Megabore column can be easily interfaced with a purge and a trap sampler and used to rapidly confirm the findings of the primary packed-column method. The Megabore column is efficient and has the inertness necessary to analyze the complete spectrum of compounds specified in EPA methods 501, 502, 503, 524, 601, 602, 624, and 1624, which encompass both drinking water and industrial effluents. Values are given for the 23 volatile organic compounds specified in EPA method 601: 1,1-Dichloroethylene, Methylene Chloride, trans-1,2-Dichloroethylene, 1,1-Dichloroethane, Bromochloromethane, Chloroform, 1,1,1,-Trichloroethane, Carbon tetrachloride, 1,2-Dichloroethane, Trichloroethylene, 1,2-Dichloropropane, Bromodichloromethane, trans-1,3-Dichloropropene, cis-1,3-Dichloropropene, 1,1,2-Trichloroethane, Tetrachloroethylene, Dibromochloromethane, Chlorobenzene, Bromoform, 1,1,2,2-tetrachloroethane, 1,3-Dichlorobenzene(m), 1,4-Dichlorobenzene(p), and 1,2-Dichlorobenzene(o). (Peters-PTT)
W86-04985

SEQUENTIAL FLOW-INJECTION DETERMINATIONS OF CALCIUM AND MAGNESIUM IN WATERS,
Universidad Autonoma de Barcelona (Spain). Dept. de Quimica Analitica.
J. Alonso, and J. Bartroli.
Analytica Chimica Acta, Vol. 179, p 503-508, January 31, 1986. 2 tab, 3 fig, 10 ref.

Descriptors: *Calcium, *Magnesium, *Water analysis, Flow-injection analysis, Potentiometric level, Electrodes, Ions, Chemical analysis, Detection limits.

A tubular PVC membrane electrode for calcium without inner reference solution and a device for location of the reference electrode are described. In the flow-injection system, calcium is determined potentiometrically and then magnesium is determined by atomic absorption spectrometry. The results are comparable to those of established methods, with a superior sampling frequency. Calcium may be detected in the range .00005-.1 M and magnesium in the range 0-10 mg/L. Flow rates of 3-6 ml/min are possible with a sampling frequency of 60-90/hr. (Peters-PTT)
W86-04989

DETERMINATION OF BROMIDE IN NATURAL WATERS BY FLOW INJECTION ANALYSIS,
T. Anfalt, and S. Twengstrom.
Analytica Chimca Acta, Vol. 179, p 453-457, January 31, 1986. 3 tab, 2 fig, 6 ref.

Descriptors: *Bromides, *Oil industry, *Water analysis, Flow-injection analysis, Ammonia, Cya-

nide, Humic substances, Baltic Sea, Brackish water, Saline water intrusion.

The phenol red method was adapted to a flow-injection system and interferences studied by using a two-channel valve. A rapid and accurate method for following the bromide/chloride ratio is of interest not only for tracing sea water in fresh water but also for monitoring pollution, e.g., from the petroleum industry. A fast means of evaluating interferences is provided. Standards are injected from one loop of the valve while the possible interferent is injected from the other. Ammonia, cyanide, and humic substances interfere. Bromide can be determined down to 2 micromolar at a rate of 80 samples per hr. The method was tested using brackish water samples from the Baltic Sea. (Peters-PTT)
W86-04990

FLOW-INJECTION POTENTIOMETRIC STRIPPING ANALYSIS - A NEW CONCEPT FOR FAST TRACE DETERMINATIONS,
Hahn-Meitner-Inst. fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.).
W. Frenzel, and P. Bratter.
Analytica Chimica Acta, Vol. 179, p 389-398, January 31, 1986. 1 tab, 4 fig, 29 ref.

Descriptors: *Flow injection analysis, *Water analysis, *Heavy metals, *Chemical analysis, *Water analysis, Zinc, Lead, Copper, Potentiometric stripping, Drinking water, Multi-element analysis.

Flow-injection potentiometric stripping analysis (f.i.p.s.a.) is suggested for use for heavy metal determinations whenever high sample throughput is required. The ability to determine simultaneously up to four elements at the mg/L level in a few seconds is an outstanding feature of f.i.p.s.a. The simple instrumentation used, with extremely short residence times (below 1 s), permits a sample throughput of 200/hr. On-line sample manipulation (e.g., dilution and matrix modification) is possible with one- and two-channel flow systems. The utility of f.i.p.s.a. was evaluated by comparing response, sensitivity, and practical aspects of four different flow-through cells. The method was successfully applied to the fast sequential measurement of zinc, lead and copper in tap water and to the direct determination of lead and cadmium in acid digests of biological samples without further treatment. Because it is a microanalytical technique, f.i.p.s.a. can be applied whenever small or rare samples have to be analyzed. (Peters-PTT)
W86-04991

RAPID DETERMINATION OF CHEMICAL OXYGEN DEMAND IN WASTE WATERS AND EFFLUENTS BY FLOW INJECTION ANALYSIS,
Loughborough Univ. of Technology (England). Dept. of Chemistry.
For primary bibliographic entry see Field 5G.
W86-04992

COMPARISON OF MULLER-KAUFFMANN TETRATHIONATE BROTH WITH RAPPAPORT-VASSILIADIS (RV) MEDIUM FOR THE ISOLATION OF SALMONELLAS FROM SEWAGE SLUDGE,
Manchester Univ. (England). Dept. of Bacteriology and Virology.
P. Rhodes, and L. B. Quesnel.
Journal of Applied Bacteriology, Vol. 60, No. 2, p 161-167, February 1986. 4 tab, 4 fig, 18 ref.

Descriptors: *Sewage bacteria, *Sludge, *Wastewater, Salmonella, Muller-Kauffmann Tetrathionate Broth, Rappaport-Yassiliadis medium.

Inoculum size affects the efficiency of sampling and isolation of salmonellae from inoculated sewage samples by Rappaport-Vassiliadis (RV) medium kinetic data show that small inocula increase efficiency. The efficiency of RV medium and Muller-Kauffman tetrathionate broth (MKT) by conventional isolation frequency determinations were compared and the effect of the addition of a sulphamandelate supplement to brilliant green agar was evaluated. Isolation rates for RV (42 C) were higher even when MKT (43 C) performance was improved by the use of brilliant green sulphamandelate agar. Kinetic results show that the suppression of the competing flora was poorer in MKT than in RV. The use of high inoculam to medium volume ratios (e.g., 1:5000) increased the isolation rates from RV. The results indicate that the most efficient means for isolating salmonellae present in low numbers in sewage-polluted samples is as follows: 1) pre-enrich in buffered peptone water at 37 C for 20-24 hr; 2) inoculate 20 microliters into 20 ml RV, incubate at 42 C for 24 hr; 3) select for salmonellae on agar at 37 C; and 4) confirm by biochemical and serological tests. (Peters-PTT)
W86-04994

SEROTYPES OF VIBRIO PARAHAEMOLYTICUS ISOLATES FROM HYDROBIOLOGICALLY DISSIMILAR AQUATIC ENVIRONMENTS,
National Inst. of Cholera and Enteric Diseases, Calcutta (India).
G. B. Nair, B. L. Sarkar, M. Abraham, and S. C. Pal.
Applied and Environmental Microbiology AEMIDF, Vol. 50, No. 3, p 724-726, September 1985. 1 tab, 18 ref.

Descriptors: *Aquatic bacteria, *Aquatic environments, *Vibrio parahaemolyticus, *Pathogenic bacteria, Public health, Human diseases, Enteric bacteria, India, Epidemiology, Estuaries, Mangrove swamps, Streams, Water pollution.

Serological analysis of the O and K antigens was performed on 324 isolates of Vibrio parahaemolyticus obtained from three hydrobiologically dissimilar aquatic environments in India. Only 50.9% of the strains could be serotyped; the largest number of untypable strains and the lowest serological diversity were observed in samples from freshwater. Three serotypes dominated among all biotopes; these were 02:K28, 05:K17, and 02:K3. A distinction was observed between serotypes of environmental and clinical origins. Serotype 01:K56, dominant among human diarrheal cases in Calcutta, was not isolated from any of the environments in this study, while the dominant environmental serotype 02:K28 was not recovered from diarrheal cases. The elusivity of enteropathogenic serotypes in the environment is noteworthy in an area such as Calcutta, where occurrence of gastroenteritis and human carriage of the organisms are high, and where there is a large-scale interaction between humans and the environment. Another significant finding was the prevalence of similar serotypes in vastly heterogeneous environments. These include not only estuarine and mangrove realms, which are brackish, but also freshwater environments where halophiles are not expected. (Doria-PTT)
W86-05062

BENCH TESTING OF ON-LINE TOTAL RESIDUAL CHLORINE ANALYZERS,
Canviro Consultants Ltd., Kitchener (Ontario).
S. G. Nutt, E. L. Jeffers, D. T. Vachon, and W. W. Schuk.
Journal of the Water Pollution Control Federation JWPFA, Vol. 57, No. 9, p 948-954, September 1985. 5 fig, 4 tab, 9 ref.

Descriptors: *Bench testing, *Residual chlorine, Bench flumes, Monitoring, Instrumentation, Design criteria, Testing procedures.

The application of automated monitoring instrumentation and process control strategies is well recognized in all areas of engineering as one of the best means of improving reliability, performance, and economics. However, there is limited acceptance is there because of a lack of confidence in the reliability of available instrumentation. In 1982, an organization to evaluate water and wastewater instrumentation was formed. Total Residual Chlorine (TRC) analyzers were selected as the first category of instrumentation and it was found that bench-scale tests are a useful screening device prior to expensive field testing, and can lead to improved instrument design and performance. The bench-test program identified significant differences in the performance of the four on-line TRC analyzers. The differences are pertinent to the procurement of a specific instrument for a particular application. All of the instruments exhibited acceptable accuracy over the normal operating span. The accuracy of one test unit was affected adversely by changes in ambient temperature. One test unit had significantly longer response times to changes in input concentration. The bench-test program also identified design flaws in the instruments tested that would affect analyzer performance in a field environment. One instrument manufacturer has acknowledged problems with the instrument and is modifying the unit. A second manufacturer may also make modifications to its analyzer. Thus, the objective of improving instrument design and performance through independent, rigorous testing is being achieved. (Khumbatta - PTT)
W86-05069

SECOND DERIVATIVE ULTRAVIOLET SPECTROSCOPY AND SULFAMIC ACID METHOD FOR DETERMINATION OF NITRATES IN WATER,
Santiago Univ. (Spain). Dept. de Analisis Quimico y Bromatologia-Toxicologia.
J. Simal, M. A. Lage, and I. Iglesias.
Journal of the Association of Official Analytical Chemists JANCA, Vol. 68, No. 5, p 962-964, September/October 1985. 2 fig, 2 tab, 14 ref.

Descriptors: *Nitrates, *Water analysis, *Second derivative ultraviolet spectroscopy, Spectroscopy, Chemical analysis.

Ultraviolet Spectroscopy is very helpful in identification and quantitation of nitrates because of its simplicity and low cost. However, similarly structured compounds such as nitrite ions show a very similar absorption spectrum and will interfere. Second derivative ultraviolet (UV) spectroscopy is used for the identification and quantitation of nitrates in water giving good precision and accuracy. Nitrite interference is eliminated with sulfamic acid (20 mg sulfamic acid/L eliminates up to 10 mg NO2(-)/L); interference from organic matter can be cancelled with the use of second derivative UV spectroscopy. The nitrites can be calculated indirectly. (Khumbatta-PTT)
W86-05072

SIMPLIFIED METHOD FOR THE EXTRACTION OF THE METALS FE, ZN, CU, NI, CD, PB, CR, CO AND MN FROM SOILS AND SEWAGE SLUDGES,
Rothamsted Experimental Station, Harpenden (England). Dept. of Soils and Plant Nutrition.
S. P. McGarth, and C. H. Cunliffe.
Journal of the Science Food and Agriculture, Vol. 36, No. 9, p 794-798, September 1985. 4 tab, 2 ref.

Descriptors: *Pollutant identification, *Atomic absorption spectrophotometry, *Metals, *Soils, *Sewage sludge, Heavy metals, Soil analysis, Trace elements, Spectral analyses, Emission spectroscopy.

The use of atomic absorption and emission spectrophotometry permits rapid measurement of many metals of agricultural, environmental and geochemical importance. This is especially true of computer-controlled, multi-element inductively-coupled plasma atomic emission spectrometry. Sample preparation and digestion processes for soils, sediments and sludges are in many cases the most time-consuming parts of such analytical procedures. The method described involves digestion of soil samples with aqua regia in tubes heated in block digesters. At least nine metals can be determined in the resulting solutions with errors of $<5\%$. The results compare favorably with those from reflux aqua regia and averaged 88% of the certified total values for reference soils and 88% of those for referance sewage sludges. It is concluded that the proposed method is faster and more economical than the reflux methods now in use and gives results sufficiently close to the accepted values for the different soils and sludges used as reference materials to be of value in the routine monitoring of the metal content of soils and sludges. (Khumbatta-PTT)

W86-05076

SEASONALITY OF BACTERIAL QUALITY OF WATER IN A TROPICAL DEVELOPING COUNTRY (SIERRA LEONE),
United Nations Development Programme, Freetown (Sierra Leone). Rural Water Supply Programme.
R. C. Wright.
Journal of Hygiene, Cambridge, Vol. 96, No. 1, p 75-82, February 1986. 2 tab, 2 fig, 17 ref.

Descriptors: *Sierra Leone, *Tropical regions, *Bacteria, *Water quality, Drinking water, Seasonal variations, Salmonella, Clostridium, Streptococcus, Escherichia coli, Bioindicators.

The seasonal variations in water quality which might occur in tropical developing countries is identified both in general terms and with respect to specific source types. Natural water sources used as drinking water supplies by rural settlements in Sierra Leone were examined over a one year period to detect seasonal variations in bacterial quality. The 37 C colony count, levels of selected fecal indicator bacteria and the incidence of Salmonella spp. were monitored. A seasonality was demonstrated for all variables. The counts generally increased with the progression of the dry season and culminated in peaks at the transition from the dry to wet season. However, a statistically significant divergence was seen between the counts of the fecal groups (fecal coliform and fecal streptococcus (FS) and counts of the specific indicators, Escherichia coli and streptococcus faecalis, respectively, as these increased during the dry season. It is recommended that membrane filtration be used in preference to the multiple-tube test. (Peters-PTT)
W86-05106

COMPOUND-SPECIFIC DETERMINATION OF ARSENITE AT SUB-NANOGRAM CONCENTRATIONS IN FRESHWATER AND SEAWATER,
Jadavpur Univ., Calcutta (India). Dept. of Chemistry.
D. Chakraborti, F. Adams, and K. J. Irgolic.
Fresenius's Zeitschrift fur Analytische Chemie, Vol. 323, No. 2, p 340-342, February 1986. 1 tab, 18 ref.

Descriptors: *Arsenic, *Rivers, *Chemical analysis, Cadmium, Cobalt, Copper, Chromium, Iron, Manganese, Nickel, Lead, Zinc, Drinking water, Arsenic compounds, Heavy metals, Chlorine, Water analysis.

Arsenite is quantitatively and selectively extracted into carbon tetrachloride in the presence of arsenate, methylarsonic acid, and dimethylarsinic acid by 0.5% (w/v) aqueous solutions of ammonium sec-butyldithiophosphate. The organic extract is evaporated to dryness and the residue mineralized with concentrated nitric acid. The arsenic in this solution (5% oxalic acid) is reduced by sodium borohydride to arsine. The arsine is passed into a DC helium arc and the arsenic emission monitored at 228.8 nm. The detection limit of the extraction/hydride generation system is 0.6 ng As/liter (expressed as the concentration that must be present in a 500 ml sample subject to extraction), approximately 150 times better than hydride generation without extraction. Arsenic compounds other than arsenite do not interfere. The effect of heavy metals on the extraction and determination of arsenite was studied by applying the method to 500 ml of synthetic river water containing 200 ng As, 20 micrograms each of Cd, Co, Cu, Cr, Fe, Mn, Ni, Pb, and Zn chlorides or nitrates, and Na2EDTA. The recovery of arsenite was 106 + or - 4%. In the absence of EDTA only 80% of the arsenite was recovered. Seawater from the Gulf of Mexico was found to have 38 ng As per liter, a concentration similar to that in other seawater samples (50 ng/l). The low concentration of arsenite in tap water (3 ng As/l) is caused by the chlorine content of the water. Chlorine oxidizes arsenite efficiently to arsenate. (Peters-PTT)
W86-05107

IN SITU PULSE LIGHT FLUOROMETER FOR CHLOROPHYLL DETERMINATION AS A MONITOR FOR VERTICAL AND HORIZONTAL PHYTOPLANKTON DISTRIBUTION IN LAKES,
Aarhus Univ. (Denmark). Botanical Inst.
For primary bibliographic entry see Field 2H.
W86-05175

14C-LABELLING PATTERNS OF PHYTOPLANKTON: SPECIFIC ACTIVITY OF DIFFERENT PRODUCT POOLS,
Michigan State Univ., East Lansing. Pesticide Research Center.
L. M. Jensen.
Journal of Plankton Research JPLRD9, Vol. 7, No. 5, p 643-652, September 1985. 2 tab, 3 fig, 32 ref.

Descriptors: *Algae, *Limnology, *Phytoplankton, *Carbon radioisotopes, Jutland, Denmark, Biomass, Photosynthesis, Extracellular products, Primary productivity, Eutrophic lakes, Lake Hylke, Chlorophyll.

The specific activity of different algal intracellular fractions during in situ conditions was examined. Primary production, release of extracellular products (EOC) and the distribution of 14C into primary products of photosynthesis (low mol. wt. products, lipids, polysaccarides, and proteins) were investigated during two months in spring 1983 in eutrophic Lake Hylke, which is situated in the eastern part of Jutland, Denmark. After in situ incubation for a half day, each fraction was assayed for 14C activity and the standing stock of carbon. Calculation of specific activity revealed nonequilibrium conditions in all fractions. Since the intracellular fractions act as precursors of EOC, this means that the release may be seriously underestimated (3 to 20 times) by assuming isotopic equilibrium between the inorganic carbon pool and the EOC products in the extracellular medium. However, measurements of the standing stock of carbon are complicated by inclusion of nonphytoplankton material, thereby making calculation of specific activity uncertain. It is suggested that the labelled chlorophyll A technique may give more accurate determinations of phytoplankton biomass. (Author's abstract)
W86-05176

UNUSUAL MICROORGANISMS OBSERVED IN NEW ZEALAND HOT SPRINGS,
Waikato Univ., Hamilton (New Zealand). Dept. of Biological Sciences.
B. K. C. Patel, H. W. Morgan, and R. M. Daniel.
Microbial Ecology MCBEBU, Vol. 12, No. 2, p 181-186, June 1986. 2 fig, 1 tab, 13 ref.

Descriptors: *Thermal springs, *Electron microscopy, *Structure, New Zealand, Filaments, Corrosion, Turbulence.

A method, used for incubating electron microscope grids in situ in a number of corrosive and turbulent New Zealand thermal springs, is reported. There were filaments with swollen saclike structures in many of the hot springs. The saclike structures appear to be cellular and to contain cytoplasmic material, have a regular subunit pattern, and are the typical size for bacterial cells. The swollen saclike structures are thought to be the cell proper and the filamentous region are possibly appendages. No septa were observed within the filaments. (Peters-PTT)
W86-05200

METHOD FOR ENUMERATING PROTOZOA IN A VARIETY OF FRESHWATER HABITATS,
Southampton Univ. (England). Dept. of Biology.
B. M. Baldock.
Microbial Ecology MCBEBU, Vol. 12, No. 2, p 187-192, June 1986. 2 tab, 10 ref.

Descriptors: *Microbiological studies, *Protozoa, *Rivers, *Culturing techniques, Statistical analysis, Statistical methods, Statistical models.

A method developed for enumerating protozoan populations during a study of protozoa in rivers is described. The results, using fixed material, are compared with two published techniques: a culture method based on the most probable number technique and a direct count method. Problems encountered in the technique developed here are as follows: 1) organisms could only be identified according to broad taxonomic categories based on size; 2) counting samples may be time consuming; and 3) a certain amount of practice is necessary to recognize the fixed material and classify the organisms consistently. Those drawbacks are outweighed by the following advantages: 1) it can be used where numbers of protozoa are low; 2) it is possible to take a number of replicate samples; and 3) there is no need to identify all species present. (Peters-PTT)
W86-05201

RELATIONSHIP BETWEEN MICROBIAL ACTIVITY OF STREAM SEDIMENTS, DETERMINED BY THREE DIFFERENT METHODS, AND ABIOTIC VARIABLES,
Freshwater Biological Association, Wareham (England). River Lab.
J. H. Baker.
Microbial Ecology MCBEBU, Vol. 12, No. 2, p 193-203, June 1986. 3 fig, 4 tab, 24 ref.

Descriptors: *Sediments, *Stream biota, *Microbiological studies, Glucose, Phosphates, Carbon dioxide, Mud, Sand, Radioactivity techniques, Gravel.

Three methods to determine the microbial activity of stream sediments, phosphatase levels, maximum uptake velocity of radiolabeled glucose, and carbon dioxide production rates were compared. The methods were applied to different types of sediment (mud, sand, and gravel) from the same stream and to 5 samples from two different streams. Temperature, discharge, and eight other abiotic variables for each sample were also determined. The three activity methods correlated closely with each other and were measured with a similar precision. Phosphatase activity could be predicted for all sites from bulk density. The largest proportion of the variance associated with carbon dioxide production was explained by variations in percent of organic matter, but the relationship did not hold for all streams. However, a maximum of only 52% of the variation in the maximum uptake velocity of radiolabeled glucose could be explained by the abiotic variables. (Peters-PTT)
W86-05202

ENTERIC LUMINOUS MICROFLORA OF THE POND-CULTURED MILK FISH CHANOS CHANOS (FORSKAL),
Annamalai Univ., Annamalainagar (India). Centre of Advanced Study in Marine Biology.
For primary bibliographic entry see Field 2H.
W86-05204

ANALYSIS OF VOLATILE HYDROCARBON LOSSES FROM QUIESCENT WATER SOLUTIONS,
California Univ., Los Angeles. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5B.
W86-05228

DIFFUSION THROUGH A DOUBLE-SIDED PLATE: DEVELOPMENT OF A METHOD TO STUDY ALGA-BACTERIUM INTERACTIONS,
Northern Arizona Univ., Flagstaff. Dept. of Biology.
F. S. Colwell and, and H. K. Speidel.
Applied and Environmental Microbiology, Vol. 50, No. 6, p 1357-1360, December 1985. 2 fig, 1 tab, 20 ref.

Descriptors: *Alga-bacterium interactions, Microbiological studies, Culturing techniques, Wastewater analysis, Bacteria, Algae, Wastewater treatment.

Recent studies involving the interactions of bacteria and algae stress the need for consideration of

such microbial associations. The use of solvent extracts of algal cultures in the preparation of test media has been described in several alga-bacterium association studies. These studies depend on the extraction of cellular contents which are not normally excreted and probably simulate algal cell lysis. We were interested in the effects of many coexisting, viable organisms and required a simple system which allowed the simultaneous analysis of interactions of such isolates. Bacteria and algae isolated from a wastewater oxidation pond were inoculated onto opposing surfaces of double-layer agar plates (Lutri plates) to determine the usefulness of such plates for studying microbial interactions. The altered growth characteristics of various algae depending on the species of bacteria on the adjacent medium surface indicated that there was diffusion of extracellular products through the agar. The use of Lutri plates appears to be a promising qualitative method for screening alga-bacterium interactions. This technique is most applicable when the analysis for interactions involves numerous microorganisms of unknown character. (Main-PTT)
W86-05277

DETERMINATION OF CARBONATE TRACES IN HIGH-PURITY WATER BY MEANS OF CHROMATOGRAPHY,
Gesamthochschule Paderborn (Germany, F.R.). Fachbereich Chemie und Chemietechnik.
For primary bibliographic entry see Field 5F.
W86-05281

RAPID DETERMINATION IN WATER OF CHLORIDE, SULPHATE, SULPHITE, SELENITE, SELENATE AND ARSENATE AMONG OTHER INORGANIC AND ORGANIC SOLUTES BY ION CHROMATOGRAPHY WITH UV DETECTION BELOW 195 NM,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Groundwater Research.
R.G. Gerritse, and J. A. Adeney.
Journal of Chromatography, Vol. 347, No. 3, p 419-428, November 1985. 11 fig, 13 ref.

Descriptors: *Ion chromatography, *Chlorides, *Sulfates, *Sulfites, *Selenite, *Selenate, *Arsenate, *Ultraviolet radiation, Resins, Chromatography, Chemical analysis.

Single-column ion chromatography, using silica bonded ion exchangers, with UV detection below 195 nm has great potential for direct trace analysis of many organic and inorganic anions in surface and groundwater. Detection levels at the microgram/l level or less should be attainable by improvement of the stability and energy output of UV sources below 195 nm and, if possible, concentrating the sample on a pre-column before injection. When analyzing anions that are easily oxidized, special attention must be given to both sample preservation and catalytic effects of the high performance liquid chromatography materials in contact with the sample. Especially for iodide large losses occur when the concentration is less than 0.1 mg/l. (Lantz-PTT)
W86-05302

USING ATP TO DETERMINE THE CHLORINE RESISTANCE OF FILAMENTOUS BACTERIA ASSOCIATED WITH ACTIVATED SLUDGE BULKING,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-05310

BEHAVIORAL ASSAY FOR ASSESSING EFFECTS OF POLLUTANTS ON FISH CHEMORECEPTION,
Saskatchewan Univ., Saskatoon. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W86-05325

USE OF DYES AND PROTEINS AS INDICATORS OF VIRUS ADSORPTION TO SOILS,
Arizona Univ., Tucson. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W86-05330

METHYL BROMIDE IN SURFACE DRINKING WATERS,
Azienda Comunale Elettricita ed Acque, Rome (Italy).
L. Cirilli, and A. Borgioli.
Water Research, Vol. 20, No. 3, p 273-275, March 1986. 2 tab, 8 ref.

Descriptors: *Pesticides, *Pollutant identification, *Drinking water, *Gas chromatography, Assays, Surface water, Water analysis, Fungicides, Organic compounds.

A sensitive method for the gas-chromatographic determination of methyl bromide in surface drinking water is reported. The analytical principle is based on the conversion of methyl bromide into methyl iodine by reaction with sodium iodide. Reaction parameters (amount of sodium iodide added, temperature, reaction time and salinity) are reported to provide a simple, precise and sensitive analytical method with a methyl bromide detection threshold of approximately .005 micrograms/liter. (Author's abstract)
W86-05331

DETERMINATION OF THE PERCENTAGE ADSORPTION OF UNKNOWN ORGANIC COMPOUNDS FROM WATER WITH A MULTI-COLUMN TECHNIQUE,
National Inst. for Water Research, Pretoria (South Africa).
P. G. Van Rossum.
Water Research, Vol. 20, No. 3 p 277-281, March 1986. 1 fig, 3 tab, 1 ref.

Descriptors: *Pollutant identification, *Adsorption, *Organic compounds, *Drinking water, Activated carbon, Water analysis, Dyes, Separation technique.

A technique is presented for the determination on a laboratory scale of the percentage removal from water, by an adsorption column system, of one or more organic compounds which give a linear response in the column eluate. This response may be due to a physical, chemical or biological effect. The technique is useful for situations where the concentrations of organic substances in water cannot be determined, either directly on water or in an extract of the water. Formulae for this technique were derived and evaluated with organic compounds which could be determined in water. The use of the technique is illustrated by screening a number of adsorbents for their capacity to remove mutagens from water. The technique is especially useful in situations where the percentage adsorption of unknown organic compounds, which can only be detected in the eluate, has to be determined. (Author's abstract)
W86-05332

SOME RECENT DEVELOPMENTS IN THE CHARACTERIZATION OF ESTUARINE PARTICULATES,
Ecole Normale Superieure, Paris (France). Lab. de Geologie.
J. M. Martin, J. M. Mouchel, and P. Nirel.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 83-92, 1986. 9 fig, 29 ref.

Descriptors: *Estuaries, *Particulate matter, *Chemical properties, *Physical properties, Surface area, Cation exchange, Heat of immersion, Aluminum, Trace elements.

Specific surface area (SSA), cationic exchange capacity (CEC) and heat of immersion (delta H) have been measured on native untreated suspended sediment and after oxidation with 15% H2O2. SSA and delta H have also been measured on samples leached with NaOH and Na-dithionite in order to remove amorphous aluminosilicates. Results indicated that SSA is controlled by amorphous oxides and is related to the Al content of samples and their granulometry, suggesting an almost uniform coating of the detrital core by amorphous oxides. On the other hand, CEC and delta H, which appear to be highly correlated, are controlled by both organic matter and amorphous oxides. Studies on electrophoretic mobility have provided additional data on the excess of charge at the interface between suspended matter and electrolytic medium. Particles in suspension in fresh, sea, and estuarine waters appear ubiquitously to exhibit a small range of negative surface charge. This uniformity is attributed to the presence of organic surface coatings on the particles. Finally, the significance of organic and oxide coatings as carriers of trace metal pollutants is discussed. It is shown that their importance in terms of flux is usually low despite their major role in controlling solid-liquid interactions. (Lantz-PTT)
W86-05360

MOLECULAR AND CELLULAR INDICES OF POLLUTANT EFFECTS AND THEIR USE IN ENVIRONMENTAL IMPACT ASSESSMENT,
Institute for Marine Environmental Research, Plymouth (England).
M. N. Moore, D. M. Lowe, D. R. Livingstone, and D. R. Dixon.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 223-232, 1986. 5 fig, 4 tab, 27 ref.

Descriptors: *Bioindicators, *Water pollution effects, *Environmental assessment, *Chemical analysis, Environmental effects, Chemical properties, Biological properties.

This presentation considers the development of early-warning systems based on biological responses to cell injury at the molecular, subcellular levels of organization, with particular emphasis on the use of marine mussels and periwinkles as sentinel organisms for assessing pollutant effects. Responses discussed include those of the microsomal detoxication system to organic xenobiotics, functional and structural responses of lysosomes to organic and inorganic xenobiotics, quantitative structural alterations in the cells of the digestive and reproductive systems and finally genotoxicity measured using aneuploidy and sister chromatid exchange as indices of chromosomal damage. The systems discussed demonstrate that rapid and highly sensitive diagnostic tests of molecular and cellular reactions to pollutant-induced injury are available or well along the path of development. The advantage of the cellular techniques over others, for assessment of environmental impact lies in the greatly increased sensitivity which can be obtained by concentrating on a single cell type which may be a primary target for pollutants, such as hepatopancreatic digestive cells or oocytes. Although the objective of this work has been largely toxicological, the knowledge gained from the experimental manipulation of molecular and cellular systems has considerable ramifications for many aspects of fundamental biological function and molecular ecology. (Lantz-PTT)
W86-05375

EVALUATION OF THE TOXIC COMPONENTS OF TOXAPHENE IN LAKE MICHIGAN LAKE TROUT,
Michigan State Univ., East Lansing. Pesticide Research Center.
J. W. Gooch, and F. Matsumura.
Journal of Agricultural and Food Chemistry JAFCAU, Vol. 33, No. 5, p 844-848, September/October 1985. 4 fig, 1 tab, 25 ref. NA-80AA-D-00072.

Descriptors: *Chlorinated hydrocarbons, *Insecticides, *Trout, *Lake Michigan, *Pollutant identification, Thin layer chromatography, Gas chromatography, Spectroscopy.

Lake trout from Lake Michigan were analyzed for residues of the insecticide toxaphene and two of the primary toxic constituents, toxicants A and B. (Toxicant A: a mixture of 2,2,5-endo, 6-exo, 8,9,9,10- and 2,2,5-endo, 6-exo, 8,8,9,10-octachlorobornanes; toxicant B: 2,2,5-endo, 6-exo, 8,9, 10-heptachlorobornane.) Using various chromatographic techniques and mass spectrometric confirmation, these toxic cogeners were identified in Lake

Michigan trout residues. Levels of Toxicants A and B were roughly one order of magnitude or more less than the estimated total toxaphene residue. Mean levels (microgram/g wet weight) in four lake trout from Lake Michigan were as follows: total toxaphene, 4.3 + or - 3.7; toxicant toxicant A, 0.26 + or - 0.26; and toxicant B, 0.10 + or - 0.07. Since the environmentally derived toxaphene is extensively altered in comparison to the technical material, measurement of toxic congeners may be a more toxicalogically revelant measure of toxaphene-derived residues. (Rochester-PTT)
W86-05400

NATURE OF DICHLORVOS INTOXICATION IN A FRESHWATER PRAWN, MACROBRACHIUM LAMARREI (H. MILNE EDWARDS),
Gorakhpur Univ. (India). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W86-05412

5B. Sources Of Pollution

USING THE FECAL COLIFORM TEST FOR SEWER AND STORM DRAIN MAINTENANCE,
Rogue Valley Council of Governments, Central Point, OR.
For primary bibliographic entry see Field 5D.
W86-04687

SATELLITE THERMAL OBSERVATION OF OIL SLICKS ON THE PERSIAN GULF,
Japan Marine Science and Technology Center, Yokosuka.
For primary bibliographic entry see Field 7B.
W86-04689

ACID RAIN - A FURTHER LOOK AT THE EVIDENCE,
A. W. Katzenstein.
Power Engineering, Vol. 90, No. 3, p 32-36, March 1986. 5 fig, 3 tab, 8 ref.

Descriptors: *Acid rain, *Sulfates, *Chemistry of precipitation, *Soil chemistry, *Sulfur dioxide emissions, New York, New Hampshire, North Carolina, Lakes, Forests, Ecological effects.

Data on SO2 emissions, sulfate concentrations, and precipitation pH are presented to show that the acidity of rain is far weaker than generally supposed, and that the link between acid rain and ecological damage is even weaker, or nearly nonexistent. Data considered in this discussion include sulfur dioxide emissions, airborne sulfate, rainfall acidity, temporal variations in pH in upstate New York at Mays Point, Albany, and Hinckley, and the pH values for the organic and mineral soil horizons at nine sites in New York, New Hampshire, and North Carolina. In the author's view, the popular belief that acid rain is damaging lakes and forests in eastern North America rests on a narrow selection of the available data, and is not substantiated by the broader body of knowledge that is available. (Author's abstract)
W86-04704

DELINEATING ZONES OF CONTRIBUTION FOR PUBLIC SUPPLY WELLS TO PROTECT GROUND WATER IN NEW ENGLAND,
IEP, Inc., Barnstable, MA.
For primary bibliographic entry see Field 5G.
W86-04705

GAS CHROMATOGRAPHIC EVALUATION OF THE ORGANIC COMPONENTS PRESENT IN THE ATMOSPHERE AT TRACE LEVELS WITH THE AID OF CARBOPACK B FOR PRECONCENTRATION OF THE SAMPLE,
Consiglio Nazionale delle Ricerche, Rome (Italy). Ist. Inquinamento Atmosferico.
For primary bibliographic entry see Field 5A.
W86-04710

BROMINATION AND GAS CHROMATOGRAPHIC DETERMINATION OF MICRO AMOUNTS OF ACROLEIN IN RAIN WATER,
Gifu Prefecture Research Inst. for Environmental Pollution, Yabuta (Japan).
For primary bibliographic entry see Field 5A.
W86-04711

SORPTION OF TRACE METALS BY HUMIC MATERIALS IN SOILS AND NATURAL WATERS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
G. Sposito.
Critical Reviews in Environmental Control, Vol. 16, No. 2, p 193-229, 1986. 4 fig, 3 tab, 137 ref.

Descriptors: *Path of pollutants, *Fate of pollutants, *Trace metals, *Humic materials, *Soil chemistry, *Natural waters, *Quasiparticle models, Mathematical models, Thermodynamic models, Scatchard model, Buffle model, Henderson-Hasselbalch model, Perdue-Lytle model, Polyelectrolyte model, Gamble model, Molecular structure.

The quasiparticle model description of trace metal sorption by humic substances is discussed from a unified perspective, with a demonstration of the richness and flexibility of the model in its most common variants and a clear definition of its inherent limitations and advantages as an approach to the chemistry of humic materials in relation to trace metals. Topics include: thermodynamic models of trace metal sorption (proton exchange reaction, exchange selectivity coefficients), quasiparticle models (Scatchard model, Buffle model, Henderson-Hasselbalch model, Perdue-Lytle model, polyelectrolyte model, Gamble model, and conditional equilibrium constants). The conclusion is drawn that ordinary sorption experiments are not sensitive to the detailed features of trace metal-humic substance interactions. By their very nature, these experiments provide data only on the average sorption process and the parameters in the quasiparticle models that describe them reflect quasiparticle properties, i.e., averages in some sense over the properties of the many actual modes of metal-humic substance association. These parameters have no intrinsic molecular significance in themselves. That interpretation can be imposed only on the basis of ancillary molecular data. The quasiparticle parameters cannot inherently advance knowledge in the molecular structure of humic substances, but they can provide a basis for accurate metal specification calculations of great environmental importance. (Rochester-PTT)
W86-04715

SINGLET OXYGEN IN SURFACE WATERS. 3. PHOTOCHEMICAL FORMATION AND STEADY-STATE CONCENTRATIONS IN VARIOUS TYPES OF WATERS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
For primary bibliographic entry see Field 2K.
W86-04720

MEASUREMENT OF THE WATER-OCTANOL PARTITION COEFFICIENT OF 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN,
Syntex Research, Inc., Palo Alto, CA.
For primary bibliographic entry see Field 5A.
W86-04722

DENITRIFICATION IN A LIMESTONE AQUIFER IN RELATION TO THE SECURITY OF LOW-NITRATE GROUNDWATER SUPPLIES,
British Geological Survey, Wallingford (England). Hydrogeology Research Group.
A. R. Lawrence, and S. S. D. Forster.
Institution of Water Engineers and Scientists, Journal, Vol. 40, No. 2, p 159-172, April 1986. 6 fig, 3 tab, 15 ref.

Descriptors: *Limestone aquifers, *Nitrates, *Denitrification, *Groundwater pollution, Dissolved organic carbon, United Kingdom, Jurassic limestone, Thermonuclear Tritium, Oxygen, Bitumen, Bacterial physiology.

Hydrogeological, hydrochemical, and bacterial research on a small unconfined Jurassic limestone aquifer in Lincolnshire, United Kingdom, were undertaken because a severe groundwater nitrate problem exists in this system. Clear evidence of bacteriological denitrification removing nitrate from circulating groundwater: an apparent mass imbalance for nitrate; the presence of thermonuclear tritium, indicating a significant component of post-1963 recharge in the matrix pore-water despite the absence of nitrate; and the existence of substantial populations of potentially denitrifying bacteria on, or close to, fissure walls. The hydrogeological-biochemical model considered most likely to be operative involves: (1) diffusion of dissolved oxygen and nitrate from the mobile water into the limestone matrix pore-water of the fissure walls; (2) consumption of this oxygen or, under microaeroophilic conditions, denitrification by part of the 'standing attached' bacterial population; and (3) utilization of the dissolved organic carbon of the matrix pore-water for bacterial metabolism and the continual replacement of this carbon from the 'bitumen fraction' of the limestone rock itself, possibly through the activity of other related bacteria. (Rochester-PTT)
W86-04751

COPPER (2+), ZINC (2+), AND NICKEL (2+) UPTAKE BY ACTIVATED SLUDGE,
Universidad Complutense de Madrid (Spain). Dept. de Quimica Industrial.
For primary bibliographic entry see Field 5D.
W86-04755

OCCURRENCE OF CADMIUM IN CRABS (CANCER PAGURUS) AND THE ISOLATION AND PROPERTIES OF CADMIUM METALLOTHIONEIN,
Institute of Marine Biochemistry, Aberdeen (Scotland).
For primary bibliographic entry see Field 5A.
W86-04756

CADMIUM-BINDING PROTEIN (METALLOTHIONEIN) IN CARP,
Gifu Pharmaceutical Univ. (Japan). Dept. of Environmental Hygiene.
For primary bibliographic entry see Field 5C.
W86-04757

COPPER-BINDING PROTEINS IN LIVER OF BLUEGILLS EXPOSED TO INCREASED SOLUBLE COPPER UNDER FIELD AND LABORATORY CONDITIONS,
Lawrence Livermore National Lab., CA. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W86-04758

CADMIUM ACCUMULATION AND PROTEIN BINDING PATTERNS IN TISSUES OF THE RAINBOW TROUT, SALMO GAIRDNERI,
University Coll., Cardiff (Wales). Dept. of Biochemistry.
For primary bibliographic entry see Field 5C.
W86-04759

TRANSITION METAL-BINDING PROTEINS FROM THREE CHESAPEAKE BAY FISH SPECIES,
Johns Hopkins Univ., Baltimore, MD. School of Hygiene and Public Health.
For primary bibliographic entry see Field 5C.
W86-04760

NMR STUDIES OF CRAB AND PLAICE METALLOTHIONEINS,
Birkbeck Coll., London (England). Dept. of Chemistry.
For primary bibliographic entry see Field 5C.
W86-04761

CADMIUM-BINDING PROTEINS IN THE SCALLOP PECTEN MAXIMUS,

Institute of Marine Biochemistry, Aberdeen (Scotland).
For primary bibliographic entry see Field 5C.
W86-04764

ENVIRONMENTAL FATE AND AQUATIC TOXICOLOGY STUDIES ON PHTHALATE ESTERS,
Exxon Chemical Co., Baton Rouge, LA.
For primary bibliographic entry see Field 5C.
W86-04765

BENEFITS OF MICROPROCESSOR CONTROL OF CURING OVENS FOR SOLVENT-BASED COATINGS.
Centec Corp., Reston, VA.
Capsule Report EPA 625/2-84-031, September 1984. 13 p, 6 fig, 4 tab.

Descriptors: *Volatility, *Organic solvents, *Solvents, *Industrial wastes, Air pollution, Industrial development, Industrial production, Manufacturing wastes, Metal finishing wastes, Economic aspects.

Various aspects of controlling curing oven emissions are discussed. The development of a microcomputer-based system to control curing oven ventilation by continually monitoring and controlling operating parameters, such as solvent concentrations and pressure, is emphasized. The results of the program, the performance of a prototype system, and applications for other curing operations are highlighted. Results indicate that the microcomputer control system can reduce the total installed investment cost for volatile organic compounds emission control, while at the same time reducing the total fuel costs for curing and incineration. (Halterman - PTT)
W86-04818

SIMULATED TRANSPORT OF POLYCYCLIC AROMATIC HYDROCARBONS IN ARTIFICAL STREAMS,
Oak Ridge National Lab., TN.
S. M. Bartell, P. F. Landrum, J. P. Giesy, and G. J. Leversee.
Available from the National Technical Information Service, Springfield, VA. 22161 as DE82-013446, Price codes: A03 in paper copy, A01 in microfiche. CONF-810488--4 (1982). 31 p, 4 fig, 2 tab, 36 ref. EPA-79-d-X0290-1. CONF-810488--4, (1982). 31 p, 4 fig, 2 tab, 36 ref. EPA-79-d-X0290-1.

Descriptors: *Aromatic compounds, *Path of pollutants, *Model studies, *Hydrocarbons, Transport, Ecosystems, Simulation analysis, Aquatic environment, Anthracene, Naphthalene, Benzo(a)pyrene.

A model was constructed to predict transport of three polycyclic aromatic hydrocarbons (anthracene, napthalene, and benzo(a)pyrene) in artificial streams. Model processes included volatilization, photolysis, sorption to sediments and particulates, and net accumulation by biota. Simulations of anthracene transport were compared to results of an experiment conducted in the streams. The model realistically predicted the concentration of dissolved anthracene through time and space. Photolytic degradation appeared to be a major pathway of anthracene flux from the streams. (Author's abstract)
W86-04824

BIOACCUMULATION AND EFFECTS ON REPRODUCTION IN AQUATIC ORGANISMS: AN ASSESSMENT OF THE CURRENT LITERATURE,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
T. M. Dillon, and A. B. Gibson.
Miscellaneous Paper D-85-2, September 1985. Final Report. 34 p, 6 tab, 71 ref.

Descriptors: *Bioaccumulation, *Biological magnification, Aquatic animals, Aquatic environment, Water pollution, Water pollution effects, Sublethal effects, Bioassay.

An analysis of results of a literature search conducted to examine the effects on reproduction in aquatic animals is presented in narrative and tabular form. A method is described whereby tissue concentrations can be estimated (using published bioconcentration factors) from data reported in the literature where reproductive effects, but not tissue residue data, were reported. An initial compilation of information is provided for decisionmakers who seek general guidance in interpreting bioaccumulation results, as well as for decisionmakers with site-specific concerns. (Authors's abstract)
W86-04825

FATE OF TRACE METALS IN THE SEDIMENTS OF THE NEW YORK BIGHT,
Wesleyan Univ., Middletown, CT. Dept. of Earth and Environmental Sciences.
M. D. Krom, K. K. Turekian, and N. H. Cutshall.
Available from the National Technical Information Service, Springfield, VA. 22161 as DE83-001896, Price codes: A05 in paper copy, A01 in microfiche. Publication No. 2035, 1982. 74 p, 6 fig, 9 tab, 26 ref. NOAA Agreement Number NA79AA01382.

Descriptors: *Trace metals, *Metals, *Heavy metals, *Fate of pollutants, *New York Bight, Path of pollutants, Sediments, Zinc, Chromium, Copper, Lead, Nickel, Iron, Mercury, Cadmium, Path of pollutants.

In the New York Bight apex there is a very (often > 0.9) high correlation of the concentrations of zinc, chromium, copper, lead, nickel, iron, mercury and cadmium with measures of organic matter concentrations in the silt-plus-clay percentage of the sediment. The sediment is composed principally of two components: a sand with low organic matter and leachable trace metal content and a fine fraction silt or clay that is high in organic matter and leachable trace metals. The latter component contains most of the pollutants. The dredged material dumpsite in the New York Bight apex, the Christiansen Basin, and the Hudson Shelf Valley had especially high concentrations of acid-leachable trace metals. The best estimates for metal fluxes to the sediment suggest that sewage sludge may be the most important source, though all three sources (sewage sludge, dredged material, and airborne particualtes) have fluxes that are of a similar order of magnitude. (Halterman - PTT)
W86-04834

WIND AND WATER EROSION OF WASTE HEAPS AT CONCENTRATION PLANTS FOR POTASSIUM PRODUCTION,
Akademiya Nauk SSSR, Moscow. Soviet Geophysical Committee.
G. V. Bogomolov, V. P. Klementyev, and N. I. Turenkov.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 513-519, 5 ref.

Descriptors: *Erosion, *Water pollution sources, *Spoil banks, Water pollution effects, Fate of pollutants, Mine wastes, Potassium mining, Waste dumps, Wind erosion, Salt, Byelorussia, Brines, Halite, Potassium chloride, Slaine soils, Groundwater pollution, Karst, Cation exchange.

Erosion of potassium mining waste dumps in Byelorussia is a source of water pollution. These are 60-80 m high piles of material, mostly in the 0.25 to 1.0 mm diameter particle size range with a chemical composition of 91-29% halite, 2-4% potassium chloride, and a mixture of insoluble minerals. The wastes consolidate, forming three zones: upper--density of 1.6 g/cu m, porosity of up to 30-35%, and filtratin coefficient of dozens of meters per day; middle--density of 1.75-1.85 g/cu m, porosity up to 20-25%, and filtration coefficient up to 10-0.05 cm/day; and lower--density of 1.85-2.0 g/cu m, porosity up to 10-12%, and filtration coefficient of zero. Karst development at depth and relief forms on the surface are the result of precipitation. Common features include furrows, canals, honeycombs, small alveoles, cones, cirques, V-like depressions, oval wells, and interconnected galleries. Calculated erosion rates reveal that, on a 1 ha plot, brine is produced at 25 cu m/day, and solutional erosion amounts to 3.6 cu m/day. Wind erosion amounts to less than 6 tons/ha/year. Environmental damage from the brines and wind-liberated salt include salinization of agricultural lands, salt infiltration into groundwater, disturbance of soil cation exchange mechanisms, changes in balances of free vs. complexed humic acids. (See also W86-04843) (Cassar - PTT)
W86-04894

SEDIMENT QUALITY RELATED TO DISCHARGE IN A MINERALIZED REGION OF WALES,
University Coll. of Wales, Aberystwyth. Dept. of Geography.
S. B. Bradley.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 341-350, 3 fig, 2 tab, 18 ref.

Descriptors: *Suspended sediments, *Heavy metals, *Rivers, *Sediment transport, *Sediment characteristics, X-ray fluorescence, Wales, Lead, Zinc, Iron, Phosphorus, Sulfur, Copper, Chemical analysis, Magnetic studies.

The characteristics of sediments are determined in an area of known, and previously exploited, mineralization (the River Ystwyth in Wales). To evaluate relationships between sediment levels and associated metal concentrations on their surfaces under various flow conditions, analyses for metals on alluvial sediments in several floods are considered. Analysis for metals has been conducted by X-ray fluorescence spectrometry to determine concentrations of Pb, Zn, Fe, P, and S on suspended sediments, and Pb, Zn, and Cu on channel sediments. This technique is more useful than atomic absorption spectrophotometry, as analysis of surface concentrations is important to determine bioavailability, and exchange between the sediment and dissolved load. Magnetic characteristics of the sediment have also been determined and complement heavy metal analysis. It was found that surface coatings of Pb, Zn, and Cd vary with discharge. (See also W86-04896) (Halterman - PTT)
W86-04929

INFLUENCE OF SEASON, SOURCE AND DISTANCE ON PHYSICAL AND CHEMICAL PROPERTIES OF SUSPENDED SEDIMENT,
National Water Research Inst., Winnipeg (Manitoba).
E. D. Ongley.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 371-383, 5 fig, 2 tab, 37 ref.

Descriptors: *Erosion, *Suspended sediments, *Seasonal variation, Water quality, Water quality management, Sediment transport, Chemical properties, Heavy metals, Nutrients, Sediment load, Organic compounds.

A variety of issues pertinent to suspended solids within fluvial systems are explored. Implications for sampling, and the influence of source, seasonality and distance upon geochemical characteristics are discussed. The geochemically active fraction of the suspended sediment load concentrates nutrients, metals and organic contaminants by several orders of magnitude above ambient water concentrations. Because this sediment fraction tends to be flow dependent, is not depth dependent nor adequately characterized by bottom sediments, collection of suspended sediment for geochemical purposes requires new sampling strategies. Mineralogy and major element analysis together with systematic seasonal changes in physical characteristics of suspended matter can assist in identifying seasonally variant source area. Changes in sediment chemistry during downstream transport reflect a suite of biogeochemical processes which should be explicitly considered when assessing the

environmental relevance of sediment quality. Examples from ongoing research projects are presented. (See also W86-04896) (Author's abstract)
W86-04932

PARTICLE SIZE CHARACTERISTICS OF FLUVIAL SUSPENDED SEDIMENT,
Exeter Univ. (England).
M. R. Peart, and D. E. Walling.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 397-407, 6 fig, 1 tab, 24 ref.

Descriptors: *Sediment yield, *Particle size, *Suspended sediment, *Drainage area, Temporal distribution, Nutrients, Fluvial sediments, Erosion, Soil types, Water quality, Devon, England.

The role of suspended sediment in the transport of nutrients and contaminants and as a non-point pollutant is discussed, and the importance of data on particle size characteristics of the sediment is emphasized. There is a need for further work on the 'effective' particle size of suspended sediment in transit, on the relationship between the particle size characteristics of suspended sediment, and those of the source material, and on temporal variation in particle size. The relationship between the particle size characteristics of source and sediment is investigated by considering data from a number of small drainage basins in the USA and from two small basins in Devon, England. These demonstrate the importance of soil type and catchment characteristics in controlling this relationship. Temporal variations in the particle size distribution of suspended sediment are considered by highlighting the varied evidence presented in existing studies and by considering in detail data from the two small drainage basins in Devon which exhibit markedly different responses. (See also W86-04896) (Halterman - PTT)
W86-04934

TEMPORAL VARIATION OF SUSPENDED SEDIMENT PROPERTIES,
Exeter Univ. (England).
D. E. Walling, and P. Kane.
IN: Recent Developments in the Explanation and Prediction of Erosion and Sediment Yield, IAHS Publication No. 137, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 409-419, 4 fig, 5 tab, 14 ref.

Descriptors: *Suspended sediment, *Erosion, *Temporal distribution, Water quality, Nutrients, Pollutants, England, Sediment yield, Water sampling, Storm water, Sediment-water interfaces, Exe River, Devon.

Increasing awareness of the role of suspended sediment in the transport of nutrients and contaminants, of the significance of water-sediment interactions as an influence on river water quality and of the importance of sediment in nonpoint pollution, requires an improved understanding of spatial and temporal variations in suspended sediment properties. A study of suspended sediment yields in the basin of the River Exe, Devon, United Kingdom, has attempted to provide information on the nature and extent of of temporal variations in sediment geochemistry. Bulk storm water samples were collected and analysed, and automatic pumping samplers were installed at the measuring stations. Results from four measuring stations relating to major element composition, clay mineralology and organic constituents are presented. Detailed patterns of storm-period variation in sediment properties are illustrated. Certain suspended sediment properties (such as Si, Al, Fe, Ti, and K concentrations) may remain relatively constant over a range of hydrological conditions, but others (particularly those associated with the organic fraction) may exhibit considerable variation. (See also W86-04896) (Halterman - PTT)
W86-04935

CONFIRMATION OF THE WATER QUALITY MODEL CE-QUAL-R1 USING DATA FROM EAU GALLE RESERVOIR, WISCONSIN,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
J. H. Wlosinski, and C. D. Collins.
Final Report. Technical Report E-85-11, October 1985. 72 p, 19 fig, 3 tab, 33 ref, 3 append.

Descriptors: *Model studies, *CE-QUAL-R1, *Water quality, *Reliability, *Wisconsin, Index, Computer models, Computer programs, Data collections, Reservoirs, Eau Galle Reservoir, Model confirmation.

A one-dimensional model (CE-QUAL-R1) of water quality for reservoirs was evaluated using data collected on the Eau Galle Reservoir, in west-central Wisconsin. Data collected in 1981 were used for calibration; data collected in 1982 were used for confirmation. Graphical and statistical comparisons were made for over 6,500 samples representing 21 variables. The statistical test used for comparing measured versus predicted values was the Reliability Index (RI). The average RI for each variable indicated that precision was always better than a half-order of magnitude, even for variables that ranged over more than three orders of magnitude. Graphs are presented for all variables, including profiles for the date with the poorest predictions (according to the RI). In addition, comparisons of measured and predicted flux values were satisfactory, helping to ensure that reasonable predictions were made for the correct reasons. (Author's abstract)
W86-04941

DISTRIBUTION OF CARBOFURAN IN A RICE-PADDY-FISH MICROECOSYSTEM,
Science and Education Administration, Beltsville, MD. Pesticide Degradation Lab.
A. R. Isensee, and N. Tayaputch.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 36, No. 6, p 763-769, May 1986. 2 tab, 1 fig, 7 ref.

Descriptors: *Pesticides, *Fish, *Carbofuran, *Rice, *Soil, Ecosystems, Path of pollutants, Toxicity.

The usefulness of a rice-paddy-fish microecosystem to study the fate and behavior of carbofuran in a simulated rice-paddy-fish environment was determined. The potential effects of carbofuran residues on fish were studied. In a glass chamber (45 by 40 by 25 cm, containing 14 liters of water and untreated soil) a top layer of soil treated with 14 C-carbofuran was added at either 6 or 12 ppm to cover rice seeds to a depth of 1 cm. Two weeks after treatment, 50% of the C14 in the treated soil had leached into the untreated soil. After 25 days, <20% of the 14C remained in the untreated soil. At 18 days 14 L of water were added to each tank and 1 day later 14 mosquito fish were added. Two fish samples were taken 1, 3, 7, 15 and 30 days after they were added. The fish analysis is of limited value due to unexplained mortality in both the treated and control specimens. The 14C extracted from fish with acetonitrile accounted for 60% of the total 14C in fish on day 3 and then decreased to about 10% by 30 days. This indicates that 14C was being incorporated into the fish tissue. The total 14C levels increased continuously with time to 30 days. The maximum concentration of carbofuran accounted for 5 to 14% of the total 14C in the fish extracts. The identity of the unextractable 14C is unknown. (Peters-PTT)
W86-04966

HEXABROMOBENZENE AND ITS DEBROMINATED COMPOUNDS IN RIVER AND ESTUARY SEDIMENTS IN JAPAN,
Osaka Prefecture Inst. of Public Health (Japan).
I. Watanabe, T. Kashimoto, and R. Tatsukawa.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 36, No. 5, p 778-784, May 1986. 1 tab, 4 fig, 10 ref.

Descriptors: *Water pollution, *Water analysis, *Sediments, *Rivers, *Estuaries, *Hexabromobenzene, Japan, Osaka, Flame retardants, Halides, Organic compounds, Benzenes, Chemical analysis, Solubility.

A new method for the extraction of hexabromobenzene (HBB) in sediment was used in an attempt to determine more accurately HBB in sediments in Japan. The decomposition products of HBB in the environment were examined. The efficiency of the shake method for the extraction of HBB from sediment was not considered satisfactory. HBB was found in all river sediments collected from Osaka and ranged from 5.6 to 60 microgram/kg. HBB was also found in the estuarine sediments. However, its occurrence and residue levels were much lower than those in river sediments. The brominated benzenes (pentabromobenzene, tetrabromobenzene, and tribromobenzene) were also found in river sediments collected from Osaka. Sediment pollution by HBB was confined to the rivers. The extremely low solubility of HBB may be one of the reasons for this. (Peters-PTT)
W86-04968

CAUSTIC WASTE MENACES JAMAICA,
For primary bibliographic entry see Field 5C.
W86-04970

EVALUATING MATURITY AND METAL TRANSFER OF MSW COMPOST,
Faculte des Sciences Agronomiques de l'Etat, Gembloux (Belgium).
For primary bibliographic entry see Field 5E.
W86-04972

ESTIMATING RISK TO HUMAN HEALTH,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
C. R. Cothern, W. A. Coniglio, and W. L. Marcus.
Environmental Science and Technology ESTHAG, Vol. 20, No. 2, p 111-116, February 1986. 2 fig, 4 tab, 16 ref.

Descriptors: *Trichloroethylene, *Drinking water, *Risks, *Regulations, *Carcinogens, Public health, Water use, Human physiology, Standards.

The procedure involved in estimating risk to human health posed by a chemical in the environment is discussed, using trichloroethylene (TCE) in drinking water as an example. Approximately 23 million persons are exposed to TCE levels ranging from 0.5 micrograms/liter to 5 micrograms/ liter. The level of exposure to any pollutant present in drinking water is the result of many personal daily choices and several factors over which one has very little direct control, such as age or residence location. Cancer risks projected for TCE are based on assumed lifetime ingestion of 0.03 liter of drinking water for each kilogram of body weight and on the assumption that 100% of the ingested chemical is absorbed. Adults in tropical areas consume twice as much water as the average, as may adults engaged in strenuous activity. Estimates of individual risk rates are based on bioassay data from animal experiments. These data are converted to a continuous human equivalent exposure for use in risk estimates. The population risks of health damage due to TCE were estimated as the product of the number of people affected and the individual risk rate. If a drinking water standard, i.e., maximum contaminant level, for TCE were established at 7.5 microgram/liter, nationwide compliance would result in the avoidance of anywhere from < 1 to 4,000 cases of cancer. (Rochester-PTT)
W86-04977

TIRE FIRE OIL: MONITORING A NEW ENVIRONMENTAL POLLUTANT,
Virginia Dept. of General Services, Richmond. Div. of Consolidated Lab. Services.
For primary bibliographic entry see Field 5A.
W86-04979

CONTROLLING TOXICITY: AN INTEGRATED STRATEGY,
For primary bibliographic entry see Field 5G.
W86-05013

ORGANIC CONTAMINATION: WHISTLING PAST THE GRAVEYARD,
For primary bibliographic entry see Field 5G.
W86-05014

VOLATILE ORGANIC CHEMICAL CONTAMINATION OF GROUNDWATER RESOURCES IN THE U.S.,
J. Barbash, and P. V. Roberts.
Water Pollution Control Federation Journal, Vol. 58, No. 5, p 343-348, May 1986. 33 ref.

Descriptors: *Volatile organic compounds, *Groundwater pollution, Drinking water, Path of pollutants, Water pollution sources, Water quality control, Legislation, Organic compounds, Heavy metals, Radioactive wastes.

The severity and extent of groundwater-derived drinking waters by volatile organic compounds (VOCs) in the U.S. are reviewed. A broad range of chemical contaminants have been, or are likely to be, detected in groundwaters, including synthetic and petrogenic organic compounds, toxic metals and radionuclides. A focus on VOCs in this regard is motivated by several factors. First and foremost, many of these compounds show evidence of animal or human carcinogenicity, mutagenicity, or teratogenicity. Second, these compounds are quite persistent in groundwater, because of their relatively low biological and chemical reactivity. This persistence is assisted by low temperatures, absence of light and of contact with the atmosphere, and comparatively low microbial concentrations typical of groundwater environments. Third, by comparison with other organic compounds, VOCs may be tranported for relatively long distances in groundwater, as a result of their relatively weak sorption affinity and their resistance to degradation. Fourth, VOCs are widely used in both domestic and industrial applications that result in subsurface environment dispersion such as degreasing operations, septic system cleaning, pest and weed control, dry cleaning and fumigation. The combination of all of these factors is largely responsible for the frequent occurrence of VOCs in contaminated groundwaters. The severity of this problem, however measured, is likely to get worse before it gets better. Because effective governmental regulation for VOC and other toxic substance disposal has just recently been implemented, VOC entry into the sub-surface has followed a pattern of increase similar to their growth in manufacture and use. Because of the long residence times, which characterize organic solute transport in most groundwater systems, the full impact of the effects of these practices on water supplies has yet to be felt. Even if present efforts to achieve source control are successful, the legacy of past carelessness will prevail for years to come. (Lantz-PTT)
W86-05028

EVOLVING CONCEPTS OF SUBSURFACE CONTAMINANT TRANSPORT,
Robert S. Kerr Environmental Research Lab., Ada, OK.
F. Keely, D. Piwoni, and T. Wilson.
Water Pollution Control Federation Journal, Vol. 58, No. 5, p 349-357, May 1986. 2 fig, 4 tab.

Descriptors: *Groundwater movement, *Groundwater pollution, *Path of pollutants, Water analysis, Water quality control, Cost analysis.

The evolution of concepts pertinent to investigating and predicting the movement of contaminants in the subsurface is reviewed. This was done for two reasons. There seems to be widespread overconfidence among those not directly involved in groundwater quality research regarding the ability to predict transport and fate of contaminants in the subsurface. The preceding discussion should place in proper perspective the advances that have been made in recent years, by illustrating the practical implications of conceptual uncertainties that remain unresolved. There is also far too little emphasis on obtaining detailed information about the potential pathways and mechanisms that affect transport at any given site. Additional effort devoted to site-specific characterizations of natural process parameters, rather than relying almost exclusively on chemical analyses of groundwater samples, can significantly improve the quality and cost-effectiveness of the remedial actions at such sites. To underscore this point, condensed summaries are provided of the prinicipal activities, benefits, and shortcomings of three possible site characterization approaches: conventional, state of the art, and state of the science. To furthur illustrate this, a qualitative assessment of desired tradeoffs between characterization and clean-up costs is presented. As illustrated, some investments in specialized equipment and personnel will be needed to make the transition to more sophisticated approaches, but those investments will be more than paid back in reduced clean-up costs. The maximum return on increased investments is expected for the state-of-the-science approach is reached because highly specialized equipment and personnel are not widely available. It is vitally important that this philosophy be considered because the probable benefits in lowered total costs, health risks, and time can be substantial. (Lantz-PTT)
W86-05029

ACID RAIN IN WESTERN EUROPE AND NORTHEASTERN UNITED STATES -- A TECHNICAL APPRAISAL,
Ford Motor Co., Dearborn, MI. Chemistry Dept.
W. R. Pierson, and T. Y. Chang.
Critical Reviews in Environmental Control, Vol. 16, No. 2, p 167-192, 1986. 3 tab, 123 ref.

Descriptors: *Acid rain, *Europe, *United States, *Acid deposition, Sulfuric acid, Nitric acid, Acidity, Leaching.

Rain in and downwind of industrial areas in Europe and the northeastern U.S. is acidic. It is more acidic than in remote areas. Acid dry deposition may be at least as important, in terms of amount of acid deposited, as is acid rain. Evidence that acid deposition is causing biological environmental damage is largely circumstantial. Evidence that the acidification of soils and waters is caused primarily by acid deposition is not conclusive. Soil formation (or recovery) is by nature an acidifying process. There is evidence that acid deposition is providing a critical perturbation to acidity of waters in geologically sensitive areas. The forest decline in West Germany and the eastern U.S., the object of much current attention, bears the symptoms of a stress related disease; but the still unidentified stress(es) could be natural, man made, or a combination. Acidity levels in rain are high enough to warrant genuine concern and acid deposition effects on materials are well documented. Motor vehicles contribute about 10% to the European NOx and SOx emissions from which are formed the HNO3 and H2SO4 responsible for rain acidification. Motor vehicles might have a larger role in acidic dry deposition and in the spring snowmelt acidity. The acid rain phenomenon is regional in character because the acidic species and their precursors can be transported through the atmosphere for many hundreds of kilometers before removal by rain. (Peters-PTT)
W86-05039

LEACHING TESTS OF HEAVY METALS STABILIZED WITH PORTLAND CEMENT,
New Hampshire Univ., Durham.
For primary bibliographic entry see Field 5E.
W86-05054

GROUNDWATER PROTECTION STARTS BELOW THE SURFACE,
For primary bibliographic entry see Field 5G.
W86-05063

RELIABLE OZONE DISINFECTION USING OFF-GAS CONTROL,
Canviro Consultants Ltd., Kitchener (Ontario).
For primary bibliographic entry see Field 5D.
W86-05068

FIELD VALIDATION OF THE GEOHYDROLOGY SIMULATION MODEL, FEWA,
Miami Univ., Coral Gables, FL. Coll. of Engineering.
K. V. Wong, G. Yeh, and E. Davis.
Applied Mathematical Modelling, Vol. 9, No. 5, p 347-352, October 1985. 9 fig, 13 ref.

Descriptors: *Simulation, *Path of pollutants, *Groundwater pollution, *Groundwater pollution, *Geohydrology, *Aquifers, Finite elements, Mathematical models, Computer programs, Love Canal, Conesville, Ohio, Sludge disposal.

The finite element model of water flow through aquifers (FEWA) was validated using field data from the Love Canal area, NY and from the Conesville, Ohio area where the leaching and potential groundwater contaminaiton by disposal of flue gas desulfurization sludge was studied. An equation to predict the distribution of pressure head in an aquifer can be derived, based on the following factors: the continuity of fluid, the continuity of solid, the motion of media and the compressibility of water. The equation describes an initial and boundary value problem and hence the initial hydraulic head values have to be prescribed. The computed data for both cases investigated compare well with the field data, indicating that FEWA provides accurate results. The program FEWA is suitable for use in microcomputers with a user memory of <200 k words. The run time for the Love Canal case was 18 CPU seconds and for the Conesville case, 25 CPU seconds. (Khumbatta-PTT)
W86-05071

SIGNIFICANCE AND DEGREE OF ABIOSESTON CONSUMPTION IN THE FILTER-FEEDER DAPHNIA GALEATA SARS AM. RICHARD (CLADOCERA) IN LAKE BALATON,
Balatoni Limnologiai Kutato Intezete, Tihany (Hungary).
L. G. Toth, K. V. Balough, and N. P. Zankai.
Archiv fuer Hydrobiologie AHYBAY, Vol. 106, No. 1, p 45-60, 1986. 10 fig, 4 tab, 39 ref.

Descriptors: *Abioseston, *Daphnia, *Lake Balaton, Hungary, Calcium, Magnesium, Lake morphology, Limnology, Biosedimentation, Carbonates, Crustaceans, Chemical analysis, Atomic adsorption spectrophotometry.

In Lake Balaton calcium and magnesium content of gut contents and other tissues of Daphnia galeata SARS am. RICHARD (Cladocera) were investigated with dry weight measurements and atomic absorption spectrophotometry. The mineral matter consumption was estimated, and effect of abioseston on the filtering rate was studied in different seasons. The quantity of seston including calcium and magnesium carbonate strongly depends on weather conditions (e.g. the sediments are stirred up by the waves) and usually high. The abioseston consumption of Daphnia galeata is significant, a 1,000 to 10,000 times enriching of the two metals in the gut contents has happened. The mineral matter content of the guts reached 12.22 to 43.7% of the whole dry weight of the animals. An adult individual depending on its length and on the seston content of the water filtered and defecated 0.100 to 0.425 mg calcium- and magnesium-carbonate, a total of 0.101 to 1.750 mg dry weight inorganic matter a day. Thus Daphnia populations may play an important role in biosedimentation in Lake Balaton. Increases in abioseston content of the water decreases the filtering intensity and feeding of animals, and increases the defecation. 70 to 80% of calcium and magnesium content in the intact animal is due to its gut content. This fact should be taken into account in the studies regarding the accumulation of elements in zooplankton. (Lantz-PTT)
W86-05085

INVESTIGATIONS ABOUT THE FATE OF HEAVY METALS IN LAKES: II. THE ROLE OF IRON AND MANGANESE REMOBILIZATION TO THE HYPOLIMNIC ENRICHMENT OF HEAVY METALS (UNTERSUCHUNGEN ZUM VERHALTEN VON SCHWERMETALLEN IN GEWASSERN: II. DIE BEDEUTUNG DER EISEN- UND MANGAN-REMOBILISIERUNG

FUER DIE HYPOLIMNISCHE ANREICHERUNG VON SCHWERMETALLEN),
Technische Univ. Berlin (Germany, F.R.). Inst. fuer Technischen Umweltschutz.
V. G. Gunkel, and A. Sztraka.
Archiv fuer Hydrobiologie AHYBAY, Vol. 106, No. 1, p 91-117, 1986. 9 fig, 1 tab, 11 ref.

Descriptors: *Heavy metals, *Lakes, *Iron, *Manganese, *Hypolimnion, Path of pollutants, Water pollution, Chemical analysis, Oxidation-reduction reactions, Schafersee, Plotzensee, Berlin, West Germany, Chemical reactions, Sediments.

Concentrations of heavy metals in water as well as in the area of sediment and overlying water are given for two urban lakes in Berlin (West) with different man made charges. Water samples as well as undisturbed sediment cores were analyzed using a dialysis sampler to investigate microstratifications of dissolved heavy metals as a consequence of redox chemical reactions. The comparison of Schafersee and Plotzensee indicates an increase of heavy metals (Fe, Mn, Cr, Pb, Zn as well as Al) in the anoxic hypolimnion of the Schafersee during periods of lake stratification in the summer. During this period, a significant coprecipitation of heavy metals with iron oxidizing bacteria was demonstrated elsewhere. Consequently redox chemical reactions with a simultaneous mobilization of coprecipitated heavy metals seem to be important for the hypolimnic enrichment of heavy metals. Investigations of the sediment-overlying water area indicated the occurrence of microstratifications of dissolved heavy metals in the range of the redox decline. The position of these 1.5 cm large enrichment-horizons is dependent on redox potential. During periods of total circulation in Schafersee, concentrations of heavy metals are nearly homogeneous without any stratification of dissolved heavy metals in the sediment-overlying water area. A significant concentration gradient of iron and manganese is built up between sediment and hypolimnion, which leads to corresponding fluxes from the sediments to hypolimnion. Comparisons of heavy metal concentrataions in water during periods of ice cover indicated significantly higher concentrations of heavy metals in the Schafersee. Residue values of sediments also showed a higher charged sediment in Schafersee than in Plotzensee. The mean concentrations of heavy metals in sediment interstial water is not correlated to heavy metal concentrations in the hypolimnion. These results confirm a redox chemical remobilization of iron and manganese, as well as of coprecipitated heavy metals, which leads to a small enrichment-horizon of dissolved heavy metals in the sediment-overlying water area. (Lantz-PTT)
W86-05088

TWO-DIMENSIONAL POLLUTANT MIGRATION IN SOILS OF FINITE DEPTH,
University of Western Ontario, London. Geotechnical Research Centre.
R. K. Rowe, and J. R. Booker.
Canadian Geotechnical Journal CGJOAH, Vol. 22, No. 4, p 429-436, November 1985. 1 tab, 8 fig, 14 ref.

Descriptors: *Path of pollutants, *Aquifers, *Landfills, *Leaching, Analysis, Soil, Diffusion, Advection, Sorption, Desorption, Clays, Groundwater pollution.

A technique for analyzing two-dimensional migration of contaminant from a landfill into a homogeneous clayey layer takes account of the fact that the concentration of contaminant in the landfill will decrease as contaminant is transported into the soil. The analysis also allows for advective-dispersive transport within a permeable stratum (aquifer), which underlies the homogeneous layer. Consideration is given to chemical retardation arising from sorption/desorption of contaminant in the clayey layer. Some of the more important effects arising from the use of a two dimensional analysis are illustrated by means of a limited parametric study. The diffusion of contaminant from the aquifer into the clayey layer substantially reduces the concentrations of contaminant in the groundwater away from the landfill. This phenomenon may be used in specifying the buffer zone required around a landfill to ensure that the groundwater quality outside the buffer is not degraded below allowable levels. There is a critical velocity in the aquifer at which the maximum concentration at a point occurs. At greater or lesser velocities, significantly smaller concentrations may result; thus design for limiting velocities is not necessarily conservative. Advection is the predominant mechanism for mass transport within the aquifer. (Peters-PTT)
W86-05102

IMPACT OF PHYSIO-CHEMICAL STRESS ON THE TOXIGENICITY OF VIBRIO CHOLERAE,
London School of Hygiene and Tropical Medicine (England). Dept. of Tropical Hygiene.
C. J. Miller, B. S. Drasar, R. G. Feachem, and R. J. Hayes.
Journal of Hygiene, Cambridge, Vol. 96, No. 1, p 49-57, February, 1986. 4 tab, 8 ref.

Descriptors: *Toxigenicity, *Vibrio, *Aquatic bacteria, *Physico-chemical stress, Salinity, Cholera, Hydrogen ion concentration, Human diseases, Chemical properties, Water properties.

The effect of environmental stress on the toxigenicity of Vibrio cholerae 01 was investigated. The expression of toxigenicity by V. cholerae, before and after exposure to various conditions of salinity, pH and cation composition and concentration, has been measured. Exposure to these conditions did not select for hyper- or hypo-toxigenic strains. This suggests that toxigenic V. cholerae 01 are unlikely to lose their toxigenicity when exposed to environmental stress and that V. cholerae toxin production is not a response to the stresses included in this study. These results are consistent with an aquatic reservoir for toxigenic V. cholerae 01, which may be the mechanism for the maintenance of endemic cholera. (Peters-PTT)
W86-05105

IN-SITU STUDY OF THE OCCURRENCE AND RATE OF DENITRIFICATION IN A SHALLOW UNCONFINED SAND AQUIFER,
Research Council of Alberta, Edmonton. Terrain Sciences Dept.
M. R. Trudell, R. W. Gillham, and J. A. Cherry.
Journal of Hydrology, Vol.83, No. 3/4, p 251-268, March 1986. 9 fig, 32 ref.

Descriptors: *Groundwater pollution, *Path of pollutants, *Dentrification, *Sand qquifers, *Groundwater, Rodney, Ontario, Canada, Dissolved oxygen, Nitrate, Bromide, Unconfined aquifers, Tracers, Geochemistry, Organic carbon, Nitrate, Soil bacteria.

Evidence is provided for the occurrence of denitrification in shallow groundwater flow systems; the rate at which denitrification can proceed in the saturated zone was determined; and the effects of denitrification on groundwater chemistry are described. Denitrification in shallow groundwater flow systems has been inferred from the observation of declining nitrate concentrations below the water table, and corresponding decline in dissolved oxygen concentrations. An in situ injection experiment was conducted using a specially designed injection-withdrawal-sampling drive point. Nitrate and a conservative tracer (bromide) were added to natural groundwater and injected at 3 m depth into a shallow, unconfined sand aquifer near the town of Rodney, in an agricultural region of southwestern Ontario, Canada. The relative changes in concentration were observed with time. After 356 hours, the concentration of nitrate-N in the injected water declined from the initial 13 g/cu m to less than 0.1 g/cu m. The decrease in nitrate concentration was much greater than the corresponding decrease in the concentration of bromide, confirming a preferential loss of nitrate. The loss of nitrate was preceded by a decline in dissolved oxygen concentration to less than 0.1 g/cu m, and coincided with an increase in bicarbonate concentration of 142 g/cu m. The production of bicarbonate observed in the injection experiment, 2.59 mmol HCO3 (-)/mmol nitrate denitrified, agreed with that calculated using an equilibrium geochemical model of the denitrification process. An increase in the population of denitrifying organisms from 1 to 23 organisms/gram of soil was detected in core samples collected at the depth of injection 169 hours after the start of the experiment. The measured rate of denitrification ranged from 0.0078 to 0.13 g/cu m NO3(-). Nh1(-), and is in reasonable agreement with published rates for saturated soils. The organic carbon source required for denitrification is either dissolved organic carbon or soil organic carbon. Soil organic carbon, at 0.08-0.16% by weight, is adequate to denitrify large amounts of nitrate. (Peters-PTT)
W86-05112

LEACHING OF HERBICIDES THROUGH UNDISTURBED CORES OF A STRUCTURED CLAY SOIL,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
R. E. White, J. S. Dyson, Z. Gerstl, and B. Yaron.
Soil Science Society of America Journal, Vol. 50, No. 2, p 277-283, March/April 1986. 9 fig, 20 ref.

Descriptors: *Clays, *Leaching, *Herbicides, *Path of pollutants, Adsorption, Bromacil, Desorption, Napropamide, Preferential flow, Transfer function, Transport volume, Mathematical analysis, Soil structure, Moisture, Tracers.

The leaching of the herbicides bromacil and napropamide through large undisturbed cores of a structured Evesham clay (Aquic Eutrochrept) was studied under continuous and discontinuous watering regimes and at different initial moisture contents. A greater proportion of both herbicides was leached from initially dry cores than from prewet cores. This was consistent with differences in the amount of herbicide retained in the soil, most of which was retained in the top 0.05 m. Continuous leaching resulted in greater herbicide breakthrough than did the discontinuous treatment. At a continuous input rate of 12 mm/h to initially dry soil, 85% of the applied napropamide and almost 100% of the bromacil were leached out of the soil by one pore volume of water. Chloride was used as a tracer for water flow through the soil. Chloride breakthrough curves were analyzed using a transfer function equation, which yielded the median travel time of a solute molecule in the soil. For an undisturbed structured soil in which water flows preferentially down cracks and channels, even strongly adsorbed chemicals are vulnerable to leaching. (Peters-PTT)
W86-05125

PRACTICAL APPLICATIONS OF GEOLOGICAL METHODS AT THE WEST VALLEY LOW-LEVEL RADIOACTIVE WASTE BURIAL GROUND, WESTERN NEW YORK,
New York State Geological Survey/State Museum, Albany.
For primary bibliographic entry see Field 5E.
W86-05138

ANALYSIS OF GROUNDWATER QUALITY DATA OBTAINED FROM PRIVATE INDIVIDUAL WATER SYSTEMS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 2F.
W86-05140

CONTAMINATION OF FIRN LAYERS BY RADIOACTIVE FISSION PRODUCTS FROM ATMOSPHERIC FALLOUT,
Innsbruck Univ. (Austria). Inst. of Medical Physics.
W. Ambach, and W. Rehwald.
Health Physics, Vol. 49, No. 6, p 1173-1176, December, 1985. 3 fig, 19 ref.

Descriptors: *Water pollution sources, *Meltwater, *Firn, *Radioisotopes, *Drinking water, *Water pollution effects, *Fallout, Tritium, Fate of pollutants, Glaciers, Air pollution, Nuclear explosions, Path of pollutants, Radioactive wastes, Monitoring, Water pollution.

Measurements of gross beta activity and H3 concentrations of firn samples from different regions

can be used to determine environmental contamination by radioactive fallout from nuclear weapons tests in the atmosphere since 1952. The exposure dose to the population due to radioactive fission products in the drinking water supply from glacierized areas is compared to maximum acceptable concentrations derived from ICRP annual limits of intake. Even from heavily contaminated layers, the risk to the population is acceptable for Sr90, Cs137, Pm147, and H3. It was concluded that there exists no major risk to the population from drinking water obtained from activity levels from 1963 due to radioactive decay. In addition, it is suggested that the drinking water supply for the population does not originate from these firn layers only but from a mixture of melt-water from different firn layers. (Geiger-PTT)
W86-05141

TIME VARIATION OF RN 222 PROGENY CONCENTRATIONS IN RAINWATER,
Fukui Univ. (Japan). Faculty of Engineering.
For primary bibliographic entry see Field 2B.
W86-05142

RELATION BETWEEN DRINKING WATER NITRATE AND TOTAL NITRATE INTAKE,
Central Public Health Lab., London (England). Communicable Disease Surveillance Centre.
For primary bibliographic entry see Field 5G.
W86-05149

DETRITUS IN THE LITTORAL OF SEVERAL MASURIAN LAKES (SOURCES AND FATES),
Warsaw Univ. (Poland). Dept. of Hydrobiology.
E. Pieczynska, D. Balcerzak, A. Kolodziejczyk, Z. Olszewski, and J. I. Rybak.
Ekologia Polska, Vol. 32, No. 3., p 387-440, 1984. 19 fig, 17 tab, 139 ref.

Descriptors: *Littoral environment, *Detritus, *Masurian lakes, *Poland, Algae, Mollusks, Leaves, Reeds, Decomposition, Chemical analysis, Ecosystems.

In the littoral of five Masurian Lakes (northern Poland) the origin, quantity, chemical composition, and particle size of detritus were studied. Total decomposition of various plant and animal materials vary from less than 10 days (mollusk tissues and algae) to over 2 years (tree leaves and reed stalks). Animals play an important role in detritus production and transformation (feces production and shredder activity are of greatest significance). (Peters-PTT)
W86-05189

HEAVY METALS IN RAIN WATER COLLECTED OVER THE RESERVOIRS AT KOZLOWA GORA AND GOCZALKOWICE,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
M. Reczynska-Dutka.
Ekologia Polska, Vol. 32, No. 4, p 679-691, 1984. 2 fig, 4 tab, 21 ref.

Descriptors: *Heavy metals, *Pollutants, *Precipitation, *Path of pollutants, *Reservoirs, Kozlowe Gora Reservoir, Goczalkowice Reservoir, Zinc, Lead, Cadmium, Iron, Silesia, Poland, Manganese, Nickel, Copper, Cobalt, Rainfall, Air pollution.

The level of heavy metals in rainfall samples collected above the surface of the Kozlowa Gora and Goczalkowice reservoirs is discussed. Their content in rain water was regarded as an indicator of environmental pollution. An estimation was made of the metal load brought with the precipitation to the surface of the two bodies of water. A high-degree of pollution with Zn, Pb, Cd, Mn, and Fe metals was determined. The levels in dust emissions in Silesia have also risen for the same metals. Rain water collected above the surface of Kozlowa Gora Reservoir was more heavily contaminated (Zn reached the level of 6375, Pb--420, Cd--72 micrograms/ cu decimeters) than that collected above Goczalkowice Reservoir (Zn up to 967, Pb--63, Cd--24 micrograms/cu decimeter), which is further from plants emitting dusts. At Kozlowa Gora, the load per 1 ha of reservoir area of metals falling with rain was twice as high, and of Zn as much as 7 times higher than that estimated for Goczalkowice Reservoir. (Peters-PTT)
W86-05195

SECOND-ORDER APPROACH FOR THE MODELING OF DISPERSIVE TRANSPORT IN POROUS MEDIA: 1. THEORETICAL DEVELOPMENT,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
A. F. B. Tompson, and W. G. Gray.
Water Resources Research WRERAO, Vol. 22, No. 5, p 591-599, May 1986. 1 fig, 49 ref. DOE Contract No. DE-AC02-83ER60170.

Descriptors: *Path of pollutants, *Dispersion, *Model studies, *Water transfer, *Porous media, Capillary water, Theoretical analysis, Mathematical models, Mathematical studies, Physical properties, Darcy's law, Viscosity.

A new mathematical formulation to represent dispersive transport in porous media has been developed. The new approach is based solidly upon physical principles and avoids the direct constitutive description of dispersion as a purely diffusive phenomenon. For simplicity, the new model was developed for an idealized, two-phase, isotropic porous medium characterized by a constant porosity, fluid viscosity and density, and molecular diffusivity, and it did not include any interphase mass transport. The new equation is a more general representation, which avoids the complications and questions that arise concerning the coefficients associated with the Fickian approximation for dispersion. The approach regards the dispersion term in the macroscopic mass transport equation as a new independent variable f, for which a separate, coupled balance equation is derived. Constitutive relationships are developed for a number of the source terms arising in the averaged dispersion equation. The coupled transport and dispersion equations along with Darcy's law and the macroscopic continuity equation constitute a closed, second-order model for dispersion in a porous medium. (see also W86-05206)(Lantz-PTT)
W86-05205

SECOND-ORDER APPROACH FOR THE MODELING OF DISPERSIVE TRANSPORT IN POROUS MEDIA: 2. APPLICATION TO SOLUTE MOTION IN PIPES AND CAPILLARY TUBES,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
A. F. B. Tompson, and W. G. Gray.
Water Resources Research WRERAO, Vol. 22, No. 5, p 601-614, May 1986. 13 fig, 6 tab, 17 ref, 2 append. DOE Contract No. DE-AC02-83ER60170.

Descriptors: *Path of pollutants, *Dispersion, *Model studies, *Water transfer, *Porous media, *Solute transport, Capillary water, Pipes, Mathematical models, Mathematical studies, Physical properties, Peclet number.

The second-order dispersion model, previously developed was reduced to a one-dimensional form, used to simulate the transport of a solute through a pipe or capillary tube. Such a simplification allowed the model, its coefficients, and its performance to be more easily understood. The equations are fewer and simpler, the microscopic velocity profile is known exactly, and solutions for the mean solute movement, are easily found for comparison of the model results. Numerical experiments allow the dimensionless constitutive coefficients appearing in the model to be evaluated under several flow regimes. Simple functional relationships for these coefficients in terms of the Peclet number, are developed. The model performs well using these scale independent coefficients, even at early times and short travel distances, when the traditional first-order Fickian model is inadequate. (see also W86-05205)(Lantz-PTT)
W86-05206

ROLE OF SUSPENDED SEDIMENT IN IRRIGATION RETURN FLOW CHEMISTRY, SOUTHERN ALBERTA,
Department of Energy, Mines and Resources, Ottawa (Ontario).
H. C. Joseph, and E. D. Ongley.
Water Resources Research WRERAO, Vol. 22, No. 5, p 643-654, May 1986. 5 fig, 5 tab, 32 ref.

Descriptors: *Suspended sediments, *Irrigation-return flow, *Chemical analysis, *Alberta, Water pollution, Path of pollutants, Phosphorus, Heavy metals, Irrigation water, Water quality.

Chemical impact of irrigation return flows upon receiving waters has focused on salt and sediment production. Transport of other agricultural pollutants which are preferentially associated with suspended sediment is largely unknown in western Canada and poorly addressed elsewhere because of the traditional emphasis upon whole and filtered water chemistry. This study examines the role of suspended sediment in the flux of phosphorus and metals from large-scale irrigation in semiarid southern Alberta. It establishes temporal patterns of chemical flux over the irrigation season, identifies the chemical species of phosphorus and metals, and assesses the potential for phosphorus and heavy metal impact from irrigation return flows, upon receiving riverine systems. Suspended sediment plays a major role in transport of phosphorus and heavy metals. Evidence from parent materials, prairie soils, chemical speciation, statistical relationships for metals and for phosphorus, and comparative data for suspended sediment during spring high flow in receiving rivers, when sediments originate from eroding diffuse sources, all indicate that sediment-associated phosphorus and metals in irrigation return flows are not anthropogenically enriched and do not represent an impact beyond that which is naturally occurring in receiving rivers. (Lantz-PTT)
W86-05211

CURVILINEAR FINITE ELEMENT MODEL FOR SIMULATING TWO-WELL TRACER TESTS AND TRANSPORT IN STRATIFIED AQUIFERS,
GeoTrans, Inc., Reston, VA.
For primary bibliographic entry see Field 2F.
W86-05213

SOURCES AND SINKS OF IONS IN A SOFT WATER, ACIDIC LAKE IN FLORIDA,
Minnesota Univ., Minneapolis. Dept. of Civil and Mining Engineering.
L. A. Baker, P. L. Brezonik, and E. S. Edgerton.
Water Resources Research WRERAO, Vol. 22, No. 5, p 715-722, May 1986. 4 fig, 3 tab, 36 ref.

Descriptors: *Acid rain, *Ions, *Acid water, *Florida, *Lakes, *Path of pollutants, McCloud Lake, Precipitation, Chemical analysis, Nitrites, Sulfates, Minerals, Neutralization, Groundwater, Ammonium, Chemical properties.

Fluxes and storage of water and major ions were measured for McCloud Lake, a small, acidic, soft water lake in north-central Florida, that receives 90% of its water input from direct precipitation. Wet precipitation had a volume-weighted pH of 4.5, and accounted for a H(+) flux of 420 eq/ha/yr. The deposition of SO2, NO2, and HNO3 contributed an additional 150-300 eq H(+)/ha/yr. Although precipitation passing through the sandy soils and littoral sediment was neutralized by mineral weathering, sulfate reduction or adsorption, and nitrate immobilization, groundwater was only 10% of the total water input to the lake and neutralized only about 30% of precipitation H(+) input. Compared to atmospheric deposition, lake water shows little enrichment of cations, but is depleted in SO4(2-), NO3(-), and NH4(+), while > 80% of precipitation H(+) is neutralized. The major H(+) neutralization processes within the lake are sulfate reduction (26-34 milliequivalents SO4(2-)/sq m/yr) and NO3(-) immobilization (17-20 milliequivalents NO3(-)/sq m/yr), while NH4(+) immobilization is a small internal source of H(+). Sinks and sources of cations could not be reliably calculated because of uncertainties in

groundwater inputs. Internal H(+)-consuming processes are important in lakes with no surface inlets or outlets, and which receive most of their water from direct precipitation. For these lakes, the rate and extent of acidification is largely determined by a balance between H(+) inputs and H(+) consumption by internal processes. (Lantz-PTT)
W86-05217

FIELD STUDY OF NAPROPAMIDE MOVEMENT THROUGH UNSATURATED SOIL,
California Univ., Riverside. Dept. of Earth Sciences.
W. A. Jury, H. Elabd, and M. Resketo.
Water Resources Research WRERAO, Vol. 22, No. 5, p 749-755, May 1986. 6 fig, 4 tab, 24 ref.

Descriptors: *Napropamide, *Soil water, *Solute transport, *Field tests, *Path of pollutants, Chlorides, Herbicides, Leaching, Chemical analysis, Soil tests, Adsorption, Mathematical analysis.

A pulse of chloride and napropamide, a moderately absorbed herbicide, was applied to a 1.44 ha loamy sand field and leached for 2 weeks with 23 cm net applied water. Thirty-six soil cores were taken on a 6 X 6 grid with a 12-m spacing to a depth of 3 m, and were analyzed for napropamide concentration. Prior to the field leaching experiment, 36 undisturbed soil columns taken on a 6 X 6 grid 1-m adjacent to the field samples were removed and taken to the laboratory for controlled leaching experiments. Subsamples of soil at each site were used to determine adsorption distribution coefficients by the batch equilibrium method. Distribution coefficients were also calculated from the column leaching experiments by fitting the chloride and napropamide breakthrough curves to the solution of the convection dispersion equation. Although these two methods produced similar field average absorption coefficient values and variances, they were uncorrelated. Both the field cores and the laboratory leaching experiments showed evidence of some napropamide movement without apparent adsorption. This was particularly evident in the field experiments, where 73% of the chemical was found above 10-cm, but trace concentrations reached depths down to 180 cm. (Lantz-PTT)
W86-05221

SIMULATION OF FLUID FLOW AND ENERGY TRANSPORT PROCESSES ASSOCIATED WITH HIGH-LEVEL RADIOACTIVE WASTE DISPOSAL IN UNSATURATED ALLUVIUM,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5E.
W86-05223

USE OF STREAM CHEMISTRY TO ESTIMATE HYDROLOGIC PARAMETERS,
Risk Science International, Washington, DC.
For primary bibliographic entry see Field 2K.
W86-05227

ANALYSIS OF VOLATILE HYDROCARBON LOSSES FROM QUIESCENT WATER SOLUTIONS,
California Univ., Los Angeles. Dept. of Chemical Engineering.
V. L. Vilker, and R. S. Parnas.
Water Resources Research WRERAO, Vol. 22, No. 5, p 812-818, May 1986. 6 fig, 1 tab, 16 ref. EPA Agreement No. CR-807864-02.

Descriptors: *Volatile hydrocarbons, *Fate of pollutants, Path of pollutants, *Water solutions, *Evaporation, Condensation, Mass transfer, Chemical analysis, Carbon tetrachloride, Naphthalene.

An unsteady multicomponent mass transfer analysis is presented for describing the effect of water flux (evaporation or condensation) on trace hydrocarbon losses from quiescent water bodies. For convenience, the analysis is restricted to hydrocarbons for which the Henry's constant is large enough to indicate liquid-phase control of the volatilization process. The analysis shows that the magnitude and direction of water flux, as well as water-air exposure time, determine when water flux increases, decreases, or does not affect volatilization rates. Sample calculations are given for carbon tetrachloride and naphthalene volatilization with simultaneous water evaporation. In these cases, the coupling between volatilization rate and water evaporation becomes important when exposure time is > or = 1 hr and water flux is > 10 mol/h/sq m (5 mm/d evaporation). (Lantz-PTT)
W86-05228

DISPERSION IN FRACTAL FRACTURE NETWORKS,
Disposal Safety, Inc., Washington, DC.
B. Ross.
Water Resources Research WRERAO, Vol. 22, No. 5, p 823-827, May 1986. 1 fig, 8 ref.

Descriptors: *Dispersion, *Geologic fractures, *Fractal fracture network, *Path of pollutants, *Fracture permeability, Solute transport, Mathematical analysis, Transmissivity, Groundwater.

The solute transport equation describes dispersion as a diffusion-like process characterized by a constant dispersivity, which implies that small pulses of contaminants grow as the square root of distance traveled. Measured dispersivities tend to be proportioned to the scale of the measurement, suggesting that the pulses grow in linear proportion to distance. An exponent r, defined by the relationship d is approximately equal to L to the r, where d is the standard deviation of the position of a contaminant particle, and L is the distance traversed, may be used to characterize dispersion. It takes a value 1/2 in the first case and 1 in the second. The movement of a contaminant particle is analyzed here as a random walk through a fracture network composed of fissures of varying transmissivity. If large-transmissivity fractures are sufficiently few, then one calculates r = 1/2. If large-transmissivity fractures are numerous, one obtains 2r = q + 1, where q is an exponent that describes the relationship between fracture spacing and transmissivity. Inserting the reasonable value q = 1 gives r = 1. This theory thus provides a physical basis for the observed scale-dependence of dispersivity. (Lantz-PTT)
W86-05230

DRAINAGE REQUIRED TO MANAGE SALINITY,
Agricultural Research Service, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 3F.
W86-05232

CHEMICAL REACTIONS WITHIN ROOT ZONE OF ARID ZONE SOILS,
California Univ., Davis. Water Science and Engineering Section.
J. D. Oster, and K. K. Tanji.
Journal of Irrigation and Drainage Engineering JIDEDH, Vol. 111, No. 3, p 207-217, September 1985. 6 fig, 1 tab, 24 ref.

Descriptors: *Chemical reactions, *Root zone, *Arid zone, *Soil types, *Salinity, Soil water, Chemical precipitation, Adsorption, Irrigation, Leaching, Salts, Irrigation-return flow, Path of pollutants.

The quality of an irrigation water, with respect to total salinity and individual constituents, influences the chemical character of the soil solution and irrigation return flows, including drainage waters. Dissolution, precipitation, adsorption and exchange reactions modify the salt load and composition of return flows. The effects of these reactions can be manipulated by varying the leaching fraction. A change from significant increase in total salts to substantial precipitation of calcite (soil lime) and gypsum can occur as the leaching fraction is reduced. Such a reduction in leaching fraction and the concomitant reduction in applied water will also reduce the rate at which native salts in the return flow pathway are displaced into receiving waters. Methodology exists, as illustrated by several examples, to evaluate the potential consequences of reduced leaching and chemical reactions on soil solution composition, and on the salt loads of irrigation return flows. (Lantz-PTT)
W86-05233

SALT PROBLEMS FROM INCREASED IRRIGATION EFFICIENCY,
Agricultural Research Service, Riverside, CA. Salinity Lab.
J. D. Rhoades.
Journal of Irrigation and Drainage Engineering JIDEDH, Vol. 111, No. 3, p 218-229, September 1985. 1 fig, 1 tab, 25 ref.

Descriptors: *Salinity, *Irrigation efficiency, *Irrigation effects, Arid zone, Root zone, Saline soils, Sodium, Infiltration, Leaching, Irrigation practices.

To sustain irrigated agriculture, dissolved salts cannot be permitted to build up, in the root zone, to a level which depresses crop growth. Irrigation in arid and semi-arid regions is always associated with salinity. In general, with increased on-farm irrigation efficiency higher concentrations of soluble salts occur in the root zone, but since more salt precipitation occurs within the porous soil matrix the mass of soluble salts is reduced, exchangeable sodium builds up on the cation exchange complex, available water within the soil reservoir decreases, conventional irrigation scheduling techniques become less adequate, and the need for salinity monitoring is increased. In this paper, increased efficiency is taken to mean reducing the amount of infiltrated water that is not used in evapotranspiration and which passes beyond the root zone as deep percolation, i.e., is lost through leaching. These problems are analyzed in this paper. Generally, however, the potential benefits of increasing irrigation efficiency outweigh the potential problems. (Lantz-PTT)
W86-05234

EFFECT OF IRRIGATION EFFICIENCIES ON NITROGEN LEACHING LOSSES,
Delaware Univ., Newark. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W86-05235

BASIN-WIDE IMPACTS OF IRRIGATION EFFICIENCY,
Utah State Univ., Logan. Dept. of Agricultural and Irrigation Engineering.
For primary bibliographic entry see Field 3F.
W86-05236

PREDICTING PH, ALKALINITY, AND TOTAL ACIDITY IN STREAM WATER DURING EPISODIC EVENTS,
Pennsylvania State Univ., University Park. School of Forest Resources.
J. A. Lynch, C. M. Hanna, and E. S. Corbett.
Water Resources Research WRERAO, Vol. 22, No. 6, p 905-912, June 1986. 3 fig, 6 tab, 19 ref.

Descriptors: *Acid rain, *Hydrogen ion concentration, *Alkalinity, *Streams, Water pollution effects, Chemical analysis, Headwaters, Pennsylvania, Precipitation chemistry, Acidic water, Model studies, Watersheds, Snowmelt.

Acid precipitation was found to influence significantly the chemistry of a small headwater stream in central Pennsylvania. Stream discharge during 18 storms was sampled and analyzed for pH, bicarbonate alkalinity, and titratable acidity levels. The precipitation events varied considerably in their amounts, durations, and intensities and also produced highly variable hydrologic responses from the watershed. Stream pH and alkalinity levels reacted inversely to stream discharge during storm flow periods, their lowest levels occurring almost simultaneously with peak flow. In comparison, storm flow acidity was directly related to the discharge rate. Models predicting the fluctuations in storm flow pH, alkalinity, and total acidity were developed. These models, which explained 88, 91,

and 80% of the variations in stream pH, alkalinity, and acidity, respectively, used as their independent variables such hydrometeorological parameters as antecedent flow rate, time to peak, peak flow rate, quick flow volume, and storm precipitation amounts. These results suggest strongly that the hydrologic response of a watershed has potential application as an index of stream sensitivity to changes in pH, alkalinity, and acidity during acid precipitation/snowmelt events. (Lantz-PTT)
W86-05250

EQUIVALENT FORMULATIONS FOR SOLUTE AND WATER MOVEMENT IN SOILS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
For primary bibliographic entry see Field 2G.
W86-05251

VELOCITY EFFECTS ON DISPERSION IN POROUS MEDIA WITH A SINGLE HETEROGENEITY,
Purdue Univ., Lafayette, IN. School of Chemical Engineering.
M. A. Cala, and R. A. Greenkorn.
Water Resources Research WRERAO, Vol. 22, No. 6, p 919-926, June 1986. 13 fig, 1 tab, 11 ref.

Descriptors: *Porous media, *Heterogeneity, *Path of pollutants, *Dispersivity, *Flow velocity, Simulation analysis, Permeability.

Regime changes during multifluid miscible displacement through a porous medium, containing a single heterogeneity were simulated. At very low fluid velocities (approximately 0.00005 cm/s), the displacement is predominantly controlled by diffusion. Increasing the fluid velocity caused inter-pore convection to become a factor. The third regime is at even higher velocities (0.00005 to 5000 cm/s) and is predominantly controlled by mechanical dispersion. Analysis of simulations for heterogeneous flow fields reveals a fourth regime where flow is governed by megascopic dispersion caused by heterogeneity. Flow in this regime appears to be non-Fickian. A maximum Fickian velocity was determined for various parameters of the heterogeneous flow field. The simulations show that dispersion increases significantly in a porous medium containing a single heterogeneity relative to a homogeneous medium. This heterogeneous effect is apparent in all four regimes: molecular, microscopic, macroscopic, and megascopic. The permeability ratio has the most effect, causing dispersion to increase by up to two orders of magnitude relative to the homogeneous case. Length ratio has some effect although it is not as significant as permeability ratio. Size ratio has the least effect. At fluid velocities greater than 0.001 cm/s, megascopic convection dominates and dispersion appears to be non-Fickian for permeability ratios less than 0.8 or greater than 2. (Lantz-PTT)
W86-05252

ORTHOGONAL-UPSTREAM FINITE ELEMENT APPROACH TO MODELING AQUIFER CONTAMINANT TRANSPORT,
Oak Ridge National Lab., TN. Environmental Sciences Div.
G. T. Yeh.
Water Resources Research WRERAO, Vol. 22, No. 6, p 952-964, June 1986. 6 fig, 3 tab, 35 ref. DOE Contract No. DE-AC05-840R21400.

Descriptors: *Finite element method, *Aquifers, *Groundwater pollution, Model studies, *Groundwater movement, *Path of pollutants, Mathematical studies, Peclet numbers.

An orthogonal-upstream weighting (OUW) finite element scheme, which will result in a matrix amenable to point successive overrelaxation (SOR) solution strategies, is presented for approximating the aquifer contaminant-transport equation. This scheme differs from the standard Galerkin weighting (GW) and nonorthogonal-upstream weighting (NUW) schemes in that the set of weighting functions is required to be orthogonal to the set of basis functions. These weighting functions are referred to as OUW functions and are developed for line, quadrilateral, and triangular elements. Application of those OUW functions to aquifer contaminant-transport equations results in matrix equations that can be solved using the SOR iteration technique to yield convergent solutions under all Peclet numbers. Three simple problems are used to test numerical performance and computational efficiency of the OUW finite element scheme. The proposed scheme yields comparable accuracy as the NUW finite element schemes. However, the proposed scheme is the only one among four options presented in this paper that leads to convergent SOR simulations under all transport conditions. Because the SOR iteration requires much less CPU memory and CPU time than the direct elimination solution for large problems, the OUW scheme, being susceptible to the SOR iteration, provides an alternative to solve large scale aquifer contaminant-transport problems. (Lantz-PTT)
W86-05256

SYNOPSIS OF ANALYTIC SOLUTIONS FOR THE TEMPERATURE DISTRIBUTION IN A RIVER DOWNSTREAM FROM A DAM OR RESERVOIR,
Alaska Univ., Fairbanks. Geophysical Inst.
J. P. Gosink.
Water Resources Research WRERAO, Vol. 22, No. 6, p 979-983, June 1986. 1 fig, 2 tab, 22 ref.

Descriptors: *Thermal pollution, *Rivers, *Dams, *Reservoirs, Temperature distribution, Mathematical equations, Convection, River flow, River depth, Heat transfer.

A synopsis of analytic solutions for river temperature downstream from a dam is presented. Transient, convective, and diffusive effects are considered as well as periodic and spatially varying surface heat exchange. Two new solutions of the transient equation for heat transport in a river with fluctuating surface heat exchange have been developed. The first describes the transient-convective temperature response in a river subjected to a combination of fluctuating and spatially varying surface heat transfer. The second new solution represents a complete transient-convective-diffusive solution to the equation for river temperature when surface heat exchange is dependent upon periodically varying meteorological conditions. In both of these new solutions the effects of the time varying atmospheric conditions are apparent. The river response lags behind the atmospheric forcing, with the lag increasing with river depth and forcing frequency, and decreasing with the heat exchange coefficient. The amplitude of the river thermal response to atmospheric forcing decreases with forcing frequency and surface heat exchange coefficient, and with river depth. (Lantz-PTT)
W86-05258

RESIDUES OF ORGANOCHLORINE INSECTICIDES IN FISH FROM POLLUTED WATER,
Biological Research Center, Baghdad (Iraq).
M. A. Al-Omar, N. H. Al-Ogaily, and D. A. Shebil.
Bulletin of Environmental Contamination and Toxicolology, Vol 36, No. 1, p 109-113, January 1986. 1 tab, 16 ref.

Descriptors: *Organochlorine insecticides, *Water pollution effect, *Fish, Gas chromatography, Iraq, *Path of pollutants, Toxicity, Diyala River, Baghdad, Tissue analysis, Chlordane, DDT.

Before they were banned in 1976, organochlorine (OC) insecticides were extensively used in Iraq in a malaria control program and agricultural practices. The purpose of the present work is to find out the OC residue levels in different fish species collected from a polluted region in Diyala River where the largest sewage treatment plant in Baghdad discharges treated water. Seventy fish 1-3 years old, of 11 different species were collected from the lower part of Diyala River. Muscular tissue and fat were analyzed by gas chromatography. All OC residues showed high percentage of occurance 90-100%. Concentrations detected were also high especially those of chlordane and DDT where exceptionally high average levels of these two insecticides were detected particularly in low fat content group. Generally speaking higher levels of all insecticide residues were detected in low fat content fish. (Main-PTT)
W86-05264

IMPAIRMENT OF THYROID ACTIVITY IN SAROTHERODON MOSSAMBICUS DUE TO DDT TREATMENT,
Government Coll., Sendhwa (India). Dept. of Zoology.
L. Shukla and, and A. K. Pandey.
Bulletin of Environmental Contamination and Toxicology, Vol. 36, No. 1, p 132-139, January 1986. 14 fig, 2 tab, 17 ref.

Descriptors: *Thyroid activity, *Sarotherodon mossambicus, *DDT, Tissue analysis, Fish physiology, Toxicity, Water pollution effects, Insecticides.

Involvement of fish thyroid in the altered metabolic rate and reproduction in response to organochlorine insecticide has not been well documented. This study was undertaken to know the histology and histochemical responses of the thyroid gland of Sarotherodon mossambicus to DDT at low concentration. Fifty healthy and sexually mature Sarotherodon mossambicus were brought from the local fisheries pond. The DDT (1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane) 50% Tafarol was dissolved in acetone and added to 20 liters of dechlorinated water making 0.001 ppm. The test solution was renewed on every third day. On the 10th day, the fish were decapitated. The thyroid diameter (follicular and nuclear) were determined, and the E/T ratio (Height of thyroid epithelium/diameter of thyroid follicles) was calculated. The different thyroid follicles (THF) in DDT treated fish exhibited well marked changes in their organization and structure. DDT appears to produce the antagonistic effects in the thyroid in this fish. The results have similarity to the characteristics of thyroidectomy, therefore it is evident that DDT interferes with the thyroid physiology. (Main-PTT)
W86-05267

IN VIVO METABOLISM OF FENITROTHION (0,0-DIMETHYL-0-(4-NITRO-M-TOLYL) PHOSPHOROTHIOATE) IN FRESH WATER TELEOST (TILAPIA MOSSAMBICA),
Regional Research Lab., Hyderabad (India). Entomology and Toxicology Div.
F. Anjum and, and S. S. H. Qadri.
Bulletin of Environmental Contamination and Toxicology, Vol. 36, No. 1, p 140-145, January 1986. 4 fig, 2 tab, 8 ref.

Descriptors: *Fenitrothion, *Teleosts, *Metabolism, Chromatography, Tissue analysis, Toxicity, Biotransformation, Flour beetles.

Fenitrothion is widely used against insect pests leading to the exposure of non-target organisms as well. It was decided to study fenitrothion metabolism in Tilapia mossambica (teleost) in order to understand the metabolic processes involved in the biotransformation of fenitrothion. Prestarved teleosts were divided into seven batches of ten. Six batches were exposed to 200 mg/kg body weight of fenitrothion for 24 hours. The liver, kidney and brain were dissected out. Fenitrothion and its metabolites were extracted and the number of metabolites were determined by analytical TLC. Fenitrothion was separated from its metabolites by HPLC and solvent extract was loaded on preparative silica gel TLC for separation of metabolites. Flour beetles were used to test the toxicity of fenitrothion and its metabolites extracted. The present data on in vivo metabolism of fenitrothion is indicative of oxidative-desulfuration, O-demethylation, cleavage of P-O-aryl linkage and amino derivatives acetyl fenitrothion and fenitrooxon as routes of metabolic pathway in liver, brain and kidney. (Main-PTT)
W86-05268

BIOGEOCHEMISTRY OF PCBS IN INTERSTITIAL WATERS OF A COASTAL MARINE SEDIMENT,
Woods Hole Oceanographic Institution, MA.

Dept. of Chemistry.
B. J. Brownawell, and J. W. Farrington.
Geochimica et Cosmochimica Acta, Vol. 50, No. 1, p 157-169, January 1986. 5 fig, 3 tab, 74 ref.

Descriptors: *Geochemistry, *Marine sediments, *Polychlorinated biphenyls, *Interstitial water, Fate of pollutants, Organic compounds, Pollutants, Sediment-water interface, Sediments, Sorption, New Bedford Harbor, Massachusetts, Arochlor, Path of pollutants, Dissolved solids, Microbial degradation.

Polychlorinated biphenyls (PCBs) were measured in pore waters and sediments at a site in New Bedford Harbor, Massachusetts to study partitioning processes of hydrophobic organic compounds in marine sediments. Interstitial water concentrations of total PCBs, expressed as Aroclor 1254, increased with depth in the sediments with a maximum concentration of 17.1 micrograms/L at 9-11 cm. Apparent distribution coefficients of individual chlorobiphenyls decreased with depth and were related to dissolved organic carbon levels. Results from this site suggest that most of the PCBs in pore waters are sorbed to organic colloids. A simple three-phase equilibrium sorption model can explain many features of the data, for example the decrease of the apparent distribution coefficients with depth in the sediments for all of the chlorobiphenyls measured. Changes in the composition of individual chlorobiphenyls in the sediments were also apparent. Microbial degradation appears to be responsible for large relative depletions of several PCBs with depth in the core (Mason-PTT).)
W86-05292

MEASUREMENT OF IMPORTANT PARAMETERS DETERMINING AQUEOUS PHASE DIFFUSION RATES THROUGH CRYSTALLINE ROCK MATRICES,
UKAEA Atomic Energy Research Establishment, Harwell (England). Chemistry Div.
M. H. Bradbury, and A. Green.
Journal of Hydrology, Vol. 82, No. 1/2, p 39-55, November 1985. 6 fig, 3 tab, 13 ref.

Descriptors: *Diffusion rates, *Crystalline rocks, *Rock matrices, Radioactive waste disposal, Porous media, Iodide ion diffusion, Path of pollutants, Groundwater movement, Granite, Porosity, Solute transport.

Theoretical studies on the migration of radionuclides in groundwater circulating through fissure networks have indicated the importance of diffusion into the rock matrix as a retardation mechanism. Matrix diffusion will retard all radionuclides but has particular relevance to those exhibiting little or no sorption and which would otherwise migrate at or near groundwater velocity. Diffusion measurements were made with four types of granite and a discrepancy between experiment and theory was observed. Two types of porosity are believed present: through-transport porosity, which carries the diffusion flux across the sample, and dead-end porosity, comprised of cross-linking pores and pores closed at one end. (Author's abstract)
W86-05297

TRACE METALS IN MARINE SURFACE SEDIMENTS OF THE PALOS VERDES SHELF, 1974 TO 1980,
Los Angeles County Sanitation Districts, Whittier, CA.
J. K. Stull, and R. B. Baird.
Water Pollution Control Federation Journal, Vol. 57, No. 8, p 833-840, August 1985. 12 fig, 2 tab, 31 ref.

Descriptors: *Trace metals, *Marine sediments, *Continental shelf, Organic nitrogen, Wastewater treatment, Heavy metals, Suspended solids, Benthic fauna, Water pollution effects, Pacific Ocean.

Wastewater treatment for 4 million people in Los Angeles County, California yields 350 million gallons of effluent, containing 250 metric tons of suspended solids per day. The effluent is discharged into the Pacific Ocean through two submarine outfalls equipped with multiport diffusers 3 km offshore at a depth of 60 m. Between 1973 and 1979 emission rates and sediment concentrations were substantially lowered. Chemical, physical, and biological oceanographic processes appear to have played important roles in the changes. (McFarlane-PTT)
W86-05307

CHEMICAL QUALITY OF PERCHED SEPTIC TANK EFFLUENT FOR PLANT USE AND RECHARGE,
Agricultural Research Service, Fresno, CA. Water Management Research Lab.
For primary bibliographic entry see Field 5D.
W86-05311

EVIDENCE FOR MOVEMENT OF HEAVY METALS IN A SOIL IRRIGATED WITH UNTREATED WASTEWATER,
Chile Univ., Santiago. Dept. of Analytical Chemistry.
For primary bibliographic entry see Field 5E.
W86-05322

BIOCONCENTRATION OF LIPOPHILIC COMPOUNDS BY SOME AQUATIC ORGANISMS,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
D. W. Hawker, and D. W. Connell.
Ecotoxicology and Environmental Safety, Vol. 11, No. 2, p 184-197, April 1986. 7 fig, 2 tab, 35 ref.

Descriptors: *Fate of pollutants, *Biological magnification, *Bioaccumulation, *Fish, *Mollusks, *Crustaceans, Organic compounds, Water pollution effects, Path of pollutants, Aquatic animals, Pesticides, Aromatic hydrocarbons, Hydrocarbons, Daphnia, Mathematical studies, Theoretical analysis.

Prediction of the bioconcentration of persistent chemicals from water by various aquatic organisms has important applications in the management of hazardous chemicals. The parameter usually used in assessing this behavior is the bioconcentration factor which is defined as the ratio of the concentration of the chemical in the organism to the concentration in the surrounding water. The bioconcentration factor has been found to correlate well with the octanol/water partition coefficient (P) for nondegradable lipophilic organic chemicals which have achieved equilibrium between the biotic and aqueous phases. With nondegradable, lipohilic compounds having log P values ranging from 2 to 6, direct linear relationships have been found between the logarithms of the equilibrium bioconcentration factors, and also reciprocal clearance rate constants, with log P for daphnids and molluscs. These relationships permit calculation of the times required for equilibrium and significant bioconcentration of lipophilic substances. Compared with fish, these time periods are successively shorter for molluscs, then daphnids. The equilibrium biotic concentration decreased with increasing chemical hydrophobicity for both molluscs and daphnids. In addition, new linear relationships between the logarithm of the bioconcentration factor and log P were found for compounds not attaining equilibrium within finite exposure times. (Geiger-PTT)
W86-05324

EFFECT OF AL AND HUMIC ACIDS ON THE 241 AM ADSORPTION ON THE EXOSKELETON OF THE CRAYFISH ASTACUS LEPTODACTYLUS ESCHSCHOLTZ,
Antwerp Univ., Wilrijk (Belgium).
J. Bierkens, J. H. D. Vangenechten, S. Van Puymbroeck, and O. L. J. Vanderborght.
Health Physics, Vol. 50, No. 2, p 277-280, February 1986. 1 fig, 1 tab, 13 ref, EEC Contract BIO-329-B.

Descriptors: *Fate of pollutants, *Humic acids, *Adsorption, *Bioaccumulation, *Aluminum, *Crayfish, Crustaceans, Water pollution effects, Radioisotopes, Radioactive wastes, Ecological Accumulation.

The effect of Al and humic acids on the adsorption of Am 241 by the crayfish exoskeleton (carapace) was studied in plastic containers filled with 1 liter each of exposure. The composition of these media was chosen to study the effects of humic acids in boglake sediments alone in varying concentrations and in combination with varying concentrations of Al. The radioactivity associated with the carapaces after eight days exposure to Am 241 was measured on a gamma spectrophotometer. Results indicated that when Al or humic acid are added to demineralized water, they both cause decreased adsorption. When both Al and humic acid are in solution, the concentration of the Al determines the level of Am 241 adsorption on the exoskeleton parts. In the case of Al, a conglomeration and precipitation of hydrolyzed Al and Am 241 is supposed resulting in a low radioactivity in the water, a high Am 241 particulate formation and low Am 241 adsorption. The presence of humic acid on the other hand, results in an apparently higher solubility of Am 241 in the water, a decreased percentage of Am 241 particulates and also a decreased adsorption on the carapaces. (Geiger-PTT)
W86-05328

USE OF DYES AND PROTEINS AS INDICATORS OF VIRUS ADSORPTION TO SOILS,
Arizona Univ., Tucson. Dept. of Microbiology.
S. N. Singh, M. Bassous, C. P. Gerba, and L. M. Kelley.
Water Research, Vol. 20, No. 3, p 267-272, Mar 1986. 6 tab, 12 ref.

Descriptors: *Viruses, *Tracers, *Path of pollution, *Adsorption, *Groundwater pollution, *Water pollution sources, *Soil types, Dyes, Proteins, Fate of pollutants, Indicators, Septic tanks.

Outbreaks of viral diseases have been associated with contamination of groundwater sources by viral migration from septic tanks. A better understanding of virus adsorption to soils might help elucidate the possible mechanism of subsurface virus migration and ultimate contamination of groundwater sources. The present investigation sought a simple test that could predict virus adsorption to soils. Two dyes, methylene blue (positively charged) and amaranth (negatively charged), and three proteins, ferritin, myoglobin and cytochrome-c, were evaluated as potential indicators of virus adsorption to 20 different soils. The results indicated that no single indicator could predict the adsorption pattern for the different viruses which were evaluated with their similarities to adsorption of ferritin and cytochrome-c to soils. The other three indicators, myoglobin, methylene blue and amaranth did not significantly correlate with virus adsorption. Therefore, it is proposed that a two protein indicator system could be used to evaluate soils to predict virus adsorption. (Author's abstract)
W86-05330

MICROBIAL TRANSFORMATIONS OF ARSENIC IN LAKE OHAKURI, NEW ZEALAND,
Waikato Univ., Hamilton (New Zealand). Dept. of Biological Sciences.
M. C. Freeman, J. Aggett, and G. O'Brien.
Water Research, Vol. 20, No. 3 p 283-294, 8 fig, 1 tab, 48 ref.

Descriptors: *Arsenic, *Arsenic compounds, *Microbial degradation, *Fate of pollutants, *Lakes, Lake sediments, Biodegradation, Organic compounds, Phytoplankton, Fungi, Aquatic fungi, Yeasts.

The concentration and chemical speciation of arsenic in the waters and sediments of Lake Ohakuri, New Zealand were examined. Mixed microbial populations from the sediments were tested in vitro for their ability to mediate redox transformation of inorganic arsenic. Under aerobic conditions the mixed microbial cultures were found to be able to reduce arsenic (V) to arsenic (III) and also to oxidize arsenic (III) to arsenic (V). Under anaerobic conditions only reduction of arsenic (V) to

arsenic (III) was observed. Four species of sediment fungi were isolated, grown aerobically and all were found capable of reducing arsenic (V) to arsenic (III). The role of microbial heterotrophs in determining the observed mobility and specification of arsenic in Lake Ohakuri is discussed. (Author's abstract)
W86-05333

EFFECTS OF NATURAL AND SYNTHETIC SURFACE ACTIVE SUBSTANCES ON THE ELECTROCHEMICAL REDUCTION OF CADMIUM IN NATURAL WATERS,
Institut Rudjer Boskovic, Zagreb (Yugoslavia). Center for Marine Research.
Z. Kozarac, B. Cosovic, and V. Vojvodic.
Water Research, Vol. 20, No. 3 p 295-300, March 1986. 3 fig, 5 tab, 24 ref.

Descriptors: *Fate of pollutants, *Cadmium, *Surfactants, *Organic compounds, *Electrochemistry, Electrodes, Decomposition, Oxidation-reduction potential, Heavy metals, Industrial wastewater, Seawater, Rivers.

Effects of surface active substances, natural and synthetic, in selected samples of seawater, river water and industrial effluents on the oxidation-reduction processes of cadmium have been studied by electrochemical methods and compared with the behavior of different model compounds. Kinetic parameters, transfer coefficient alpha and apparent standard rate constant of the cadmium electrode reaction have been estimated from the shape and the height of the corresponding differential pulse voltammograms using theoretical curves obtained by digital simulation of the electrode process. The measure of the inhibition effect of surface active substances on the electrode reaction of cadmium was expressed in terms of the ratio of the rate constants determined in the presence and in the absence of surface active substances. It was found that the degree of inhibition depends on the concentration and type of surface active substances and on the pH of solution. (Author's abstract)
W86-05334

REGIONAL PH-ALKALINITY RELATIONSHIP,
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2K.
W86-05338

NTA BIODEGRADATION AND REMOVAL IN SUBSURFACE SANDY SOIL,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemical and Environmental Engineering.
N. H. Baek, and N. L. Clesceri.
Water Research, Vol. 20, No. 3, p 345-349, March 1986. 5 fig, 10 ref.

Descriptors: *Biodegradation, *Detergents, *Sand, *Separation techniques, *Septic tanks, Soil columns, Fate of pollutants, Path of pollutants, Subsoil, Microbial degradation, Soil bacteria, Microorganisms, Degradation, Adsorption.

This lab-scale study examined the biodegradation and removal of nitrilotriacetic acid (NTA) in the subsurface environment, mainly sandy soils. Batch tests indicated that NTA adsorption on the sandy soils played a minor role in its removal in these soils. Removal of NTA was investigated in 50.5 mm (in diameter) by 1.17 m long soil columns under unsaturated conditions at 15 degrees. Septic tank effluent containing 20 mg NTA/l was dosed to soil columns four times a day at an overall loading rate of 1 gpd/sq ft for a 43-day period. This feed NTA concentration was routinely reduced to a steady-state concentration of 0.1 mg/l by passage through the 1.17 m of soil, after an indigenous soil microflora became sufficiently established over a 25 day period. In addition, the results of samples taken on day 21 demonstrated that greater than 75% removal of NTA can be expected in a soil depth of less than one-third meter. (Author's abstract)
W86-05339

TEMPORAL AND SPATIAL TRENDS IN METAL LOADINGS TO SEDIMENTS OF THE TURKEY LAKES, ONTARIO,
Department of Fisheries and Oceans, Owen Sound (Ontario). Great Lakes Fisheries Research Branch.
M. G. Johnson, L. R. Culp, and S. E. George.
Canadian Journal of Fisheries and Aquatic Science, Vol. 43, No. 3, p 754-762, March 1986. 5 fig, 5 tab, 23 ref.

Descriptors: *Core samples, *Bottom sediments, *Pollution loads, *Metals, *Turkey Lakes, *Ontario, *Sediments, Temporal distribution, Spatial distribution, Sault Ste. Marie, Aluminum, Iron, Manganese, Copper, Nickel, Zinc, Lead, Cadmium, Chromium, Mercury, Water pollution, Lakes, Accumulation, Precipitation.

Sediment core profiles of metal concentration and 210-Pb activity were used to calculate metal loadings of five small Precambrian Shield lakes of the Turkey Lakes system near Sault Ste. Marie, Ontario. Background, natural concentrations (pre-1900) of Al, Fe, Mn, Cu, Ni, Zn, Pb, Cd, Cr, and Hg reflected concentrations in local bedrock. Surface loading rates of Al, Cu, Ni, and Cr were not significantly greater than background rates. Fe and Mn enrichment of surface sediment and the downstream accumulation in the five lakes indicated the mobility of these elements. Four metals, Pb, Cd, Hg, and Zn, had significant anthropogenic inputs, which averaged 18, 1.7, 1.4, and 0.6 times background loadings, respectively. Precipitation loadings of Pb and Hg were several times greater than background accumulation in lake sediments. Precipitation loadings of Cu, Ni, Zn, and Cd were the same order of magnitude as background inputs to sediments. (Author's abstract)
W86-05346

STANDARDIZATION OF WATER QUALITY INFORMATION IN A TIDAL RIVER,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
T. Kusuda, T. Futawatari, Y. Awaya, K. Koga, and K. Furumoto.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 43-52, 1986. 17 fig, 5 tab, 2 ref.

Descriptors: *Water quality standards, *Tidal rivers, Japan, *Water sampling, *Monitoring, Water analysis, Rokkaku River, Water depth.

The objectives of this study were to clarify the defects of the current tidal river monitoring method and to propose a better method for obtaining water quality data (of high quality) for tidal rivers. In Japan, the Water Quality Standards for rivers also apply to tidal rivers. The method indicates that water should be sampled from 20% of the water depth below the water surface at an arbitrary time once a month. Since this method was apparently inappropriate to understand the dynamics and water profiles in tidal rivers, field surveys were conducted at different times in the River Rokkaku, which is well mixed. The results showed that the turbidity maximum moved up- and down-stream more than 10 km due to the tide. Based on this fact, a new monitoring method was proposed, which required water samples to be taken with a certain time lag from a high tide at a station. This newly proposed method improved the quality of information on water quality and made data available for ascertaining long term trends. Modifications to the new method are suggested to further improve the quality of water quality data for tidal rivers. (Lantz-PTT)
W86-05356

MONITORING EFFECTS OF CATCHMENT MANAGEMENT PRACTICES ON PHOSPHORUS LOADS INTO THE EUTROPHIC PEEL-HARVEY ESTUARY, WESTERN AUSTRALIA,
Western Australia Dept. of Conservation and Environment, Perth.
P. B. Birch, G. G. Forbes, and N. J. Schofield.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 53-61, 1986. 4 fig, 2 tab, 12 ref.

Descriptors: *Catchment areas, *Monitoring, *Phosphorus, *Peel-Harvey estuary, *Australia, Eutrophication, Non-point source pollution, Fertilizers, Agricultural runoff, Algae, Statistical models, Beaches.

Early results from monitoring runoff suggest that the program to reduce application of superphosphate to farmlands in surrounding catchments has been successful in reducing input of phosphorus to the eutrophic Peel-Harvey estuary. In the estuary this phosphorus fertilizes algae which grow in abundance and accumulate and pollute once clean beaches. The success of the program has been judged by the application of an empirical statistical model, which was derived from 6 years of data from the Harvey Estuary catchment prior to a major change in fertilizer practices in 1984. The model relates concentration of phosphorus with rate of flow and time of year. High phosphorus concentrations were associated with high flow rates, and flows early in the high runoff season (May-July). The model predicted that the distribution of flows in 1984 should have resulted in a flow-weighted concentration of phosphorus near the long-term average, when in fact the observed concentration was 25% below the long-term average. This means that the amount of phosphorus discharged into the Harvey Estuary could have been about 25% less than expected from the volume of runoff which occurred. However, several more years of data are required to confirm this trend. (Lantz-PTT)
W86-05357

ORGANIC MICROPOLLUTANTS IN DUTCH COASTAL WATERS,
Ministerie van Volksgezondheid en Milieuhygiene, Leidschendam (Netherlands).
D. van de Meent, H. A. den Hollander, W. G. Pool, M. J. Vredenbregt, and H. A. M. van Oers.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 73-81, 1986. 3 fig, 2 tab, 6 ref.

Descriptors: *Organic compounds, *Micropollutants, *Coastal waters, *Holland, North Sea, Chlorobenzenes, Nitrotoluenes, Halogenated aromatic hydrocarbons, Alkylbenzenes, Polycyclic aromatic hydrocarbons, Statistical analysis, Rhine/Meuse estuary.

During six cruises from August 1983 to July 1984, water samples were collected at nine locations in the Southern North Sea, to assess the level of contamination with some classes of organic micropollutants, for which presently little information is available. Thirty-one individual compounds (chlorobenzenes, chloronitrobenzenes, nitrotoluenes, halogenated aliphatic hydrocarbons, alkylbenzenes, polycyclic aromatic hydrocarbons) were measured. Concentration levels were found to be in the lower ng/l (ppt) range (frequently close to the blank levels or below the limits of detection). Statistical analysis revealed that both spatial and temporal variations were significant for nearly all parameters, and that nearly all parameters were significantly correlated with each other as well as with the salinity. Using principal components analysis, variations in the contamination with trace organics can be semi-quantitatively described with one component only. The highest concentrations were observed in the coastal waters north of the Rhine/Meuse estuary. Concentrations gradually decreased in a northerly direction, and fell sharply in the seaward direction. It is proposed that the observed concentration levels are the result of two physical phenomena: (1) mixing of relatively uncontaminated water from the Atlantic Ocean with polluted water from the Rhine/Meuse estuary, and (2) air-sea exchange by volatilization-, dry- and wet deposition processes. (Lantz-PTT)
W86-05359

SOLUTE DISPERSION AND SEDIMENT TRANSPORT IN ESTUARIES,
Birmingham Univ. (England). Dept. of Civil Engineering.
J. R. West, I. Guymer, Y. Sangodoyin, and K. O. K. Oduyemi.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 93-100, 1986. 5 fig, 10 ref.

Descriptors: *Estuaries, *Solute transport, *Sediment transport, *Path of pollutants, Flow velocity,

Conwy estuary, Mathematical studies, Density gradients, Mathematical equations, Flow profile, Suspended solids, Salinity.

Synoptic measurements of velocity and salinity at several points on up to five vertical profiles at a cross-section in the Conwy estuary, show that solute dispersion coefficients are affected by secondary flow induced by the interaction of transverse shear and the salinity induced longitudinal density gradient. It is concluded that both solute and suspended solids transport are strongly influenced by the density fields induced in unsteady non-uniform estuarine flows by the presence of a solute-induced longitudinal density gradient. Recent advances in fieldwork methodology have shown that a better understanding of these transport processes should be possible in the near future and hence predictive procedures may be developed for spatially and temporally varying coefficients. (Lantz-PTT)
W86-05361

INVESTIGATION OF MATERIAL TRANSPORT AND LOAD IN TIDAL RIVERS,
GKSS - Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik.
H. -U. Fanger, H. Kuhn, W. Michaelis, A. Muller, and R. Riethmuller.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 101-110, 1986. 15 fig, 17 ref.

Descriptors: *Tidal rivers, *Solute transport, *Sediment transport, *Suspended load, Particulate matter, Heavy metals, Path of pollutants, Water analysis, Model studies, Water quality control.

The transport of suspended particulate matter and of heavy metals in tidal rivers is of both ecological and economic relevance. But temporal variabilities and spatial heterogeneities considerably complicate its quantitative treatment by numerical simulation and the acquisition of representative field data for systematic investigations. As a contribution to the potential solution of this problem, a methodology has been developed which combines theoretical and experimental techniques in an effective way. A novel measuring system on board a ship allows the fast determination of hydrographic parameters, and water samples are taken in parallel from different depths. Various analytical techniques are applied for quantitative trace-element detection. The experimental data are used as boundary conditions in hydrodynamic and transport model calculations. This paper describes the experimental equipment, techniques, and numerical models. Calculated currents in the river area investigated and calculated (cross-averaged) concentrations and transports of suspended matter and heavy metals agree, so far, quite well with the experimental data, although the extent of the river section was somewhat small for a critical test of the parametrization and empirical constants assumed in the models. Therefore, the measuring basis has to be enlarged in subsequent experiments. In order to obtain long term trends from studies of this kind, the experiments have to be repeated at identical sites but under different meteorological and discharge conditions, and the temporal interpolation should be performed with the aid of permanent measuring and sampling stations at sites being representative for the cross-section of interest. (Lantz-PTT)
W86-05362

SEDIMENT MOBILITY AND ITS CONTRIBUTION TO TRACE METAL CYCLING AND RETENTION IN A MACROTIDAL ESTUARY,
Institute for Marine Environmental Research, Plymouth (England).
A. W. Morris, A. J. Bale, R. J. M. Howland, G. E. Millward, and D. R. Ackroyd.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 111-119, 1986. 7 fig, 19 ref. Department of the Environment Contract No. PECD 7/7/076.

Descriptors: *Sediment transport, *Trace metals, *Estuaries, Estuarine environment, Tamar Estuary, Path of pollutants, Iron, Manganese, Cadmium, Zinc, Chemical reactions, Metals, Pore water.

Measurements of trace metals in the dissolved, suspended particulate and sediment phases of the Tamar Estuary have been combined with observations of sediment and suspended particle mobility in an interpretation of metal cycling and retention processes within the system. Dissolved Fe, Mn, Cu and Zn distributions in the Tamar Estuary indicate substantial internal metal cycling. Appreciable proportions of the riverine dissolved metal influxes are scavenged by tidally resuspendable sediment particles within the very low salinity, high turbidity zone. Net return to the water column occurs within the mid-estuary and probably involves desorption and dissolution from tidally resuspended sediment particles in addition to direct pore water infusion. Although this metal cycling involves a particle-water metal exchange and is driven by internal cycling of resuspendable sediment, it is not evidenced by spatial variations in the metal content of suspended and superficial sediment particle populations. This is because the magnitude and rapidity of internal suspendable particle fluxes severely restrict metal concentration changes effected by chemical reactivity. The observed temporal and spatial variations in the composition of the suspended particulate material and the superficial sediment are attributable to physical processes. (Lantz-PTT)
W86-05363

CHEMICAL FRACTIONATION OF HEAVY METALS IN ANOXIC ESTUARINE AND COASTAL SEDIMENTS,
Technische Univ. Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik.
M. Kersten, and U. Forstner.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 121-130, 1986. 2 fig, 4 tab, 22 ref. BMFT Grant MFU 05438.

Descriptors: *Chemical analysis, *Heavy metals, *Estuaries, *Sediments, Coastal waters, Nickel, Lead, Copper, Zinc, Cadmium, Iron, Manganese, Suspended sediments, Hamburg, West Germany, Aeration, Chemical reactions.

Chemical extraction experiments for estimating characteristic particulate binding forms of heavy metals in anoxic marine and freshwater sediments were carried out under both the presence and absence of atmospheric oxygen during the analytical procedure. Storage methods, including aeration of anoxic sediments, do not preserve the initial fractionation patterns of heavy metals and may both increase (Ni, Pb, Cu, Zn, Cd) and decrease (Fe, Mn) their mobility. Elutriate tests of methanogenic freshwater sediments from Hamburg harbor basins, show that metals with increased carbonatic fractions (Fe, Mn), and those with predominantly sulphidic/organic fractions (Zn, Cu, Cd), are particularly sensitive to sample aeration. Transformations of oxidizable Ni (11%), Zn (62%), and Cd (67%) predominantly lead to easily reducible associations. Drying of the sediments decreases the proportion of the sulphidic/organic fraction of the metals to a stronger degree. Oxidized Zn and Cd is then found in the least stable exchangeable fraction. If pretreatment of sediment samples is done adequately, the chemical leaching approach may provide information on diagenetic effects and reaction kinetics, which influence the mobility of contaminants in highly complex matrices. (Author's abstract)
W86-05364

CADMIUM AND LEAD CYCLING BETWEEN WATER, SEDIMENT, AND BIOTA IN AN ARTIFICIALLY CONTAMINATED MUD FLAT ON BORKUM (F.R.G.),
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
D. H. Loring, and F. Prosi.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 131-139, 1986. 3 fig, 4 tab, 7 ref. Canada/German Scientific and Technological Agreement, Medium Scale Experiment: Project 1.0.0.9.

Descriptors: *Cadmium, *Lead, *Cycling, *Sediments, *Coastal waters, *Borkum, West Germany, Mud flats, Water pollution effects, Path of pollutants, Fate of pollutants, Chemical reactions, Mussels, Benthic fauna, Heavy metals.

A 'Bremerhaven caisson' was used to investigate the interactions of cadmium (Cd) and lead (Pb) with sea water, particulate matter (SPM), sediments, and biota, in an enclosed (13 sq m) tidal mud flat area on the island of Borkum (FRG). Artificial contamination was accomplished by injecting Cd as a chloride and Pb as a nitrate into the caisson so as to maintain metal concentrations of 100 micrograms/L in the inflowing water of each tidal cycle for 25 days. Each component of the system was sampled at selected intervals inside and outside the caisson. Results indicate that most (85%) of the injected Cd remained in the soluble phase while most (90%) of the Pb was transferred to the particulate phase. Cyclic changes in particulate Cd and Pb concentrations occur and indicate that Cd is progressively taken up by the SPM over each tidal cycle. However, after an initial rapid uptake, particulate Pb concentrations remain relatively constant in the system. In the sediments, Cd concentrations decrease with depth while increasing with time, with the highest increases occurring in the surface sediment layers. Lead concentrations initially remain constant with depth, but eventually Pb becomes enriched in the top 3 cm of the sediments. Biota show an exponential increase in Cd and Pb during the experiment. Lead is enriched relative to Cd by a factor of 2 in mussels, despite its low level in the dissolved phase. Infaunal benthic species have lower metal concentrations than the filter feeders. (Lantz-PTT)
W86-05365

DISTRIBUTION OF MERCURY IN THE SEDIMENTS AND FISHES OF THE LAGOONS OF AVEIRO, PORTUGAL,
Aveiro Univ. (Portugal). Dept. de Quimica.
M. F. Lucas, M. T. Caldeira, A. Hall, A. C. Duarte, and C. Lima.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 141-148, 1986. 2 fig, 4 tab, 8 ref. Junta Nacional de Investigacao Cientifica e Tecnologica (JNICT) Research Contract No. 305.81.15.

Descriptors: *Mercury, *Sediments, *Fish, *Lagoons, *Aviera, Portugal, Sieve analysis, Coastal waters, Water pollution sources, Path of pollutants, Industrial wastewater, Estuaries, Heavy metals, Chemical analysis, Bioaccumulation.

Dry and wet sieving were compared on their suitability for the size fractionation of bottom sediment samples, collected from a brackish water coastal lagoon, prior to flameless atomic adsorption analysis of the sediment concentration of total mercury. The work is aimed at identifying the most important point sources of mercury to the lagoon waters, and assessing the distribution throughout the ecosystem, of the mercury discharged. The results reported in this paper refer to the lagoon sediments and fishes. A chlor-alkali plant proved to be the most important source of mercury but its contribution has not yet been disentangled from those orginating at a pyrite roasting facility and a PVC factory operating in the same industrial park. Sewage discharges from the bankside communities are the other significant point sources of Hg. Concentrations of Hg in the superficial sediments ranged from 850 mg/kg, near the chlor-alkali sewer outlet, to 0.05 mg/kg in the intertidal sands of the coastal beaches. Sewage-affected sediments have concentrations of Hg in the range of 1 to 2 mg/kg. The concentrations observed in the water samples and superficial sediments suggest that some of the Hg historically discharged into the lagoon may have been exported to the Atlantic Ocean coastal waters. Bioaccumulation of Hg in fish tissues show the usual dependence on species' territoriality, feeding habits and size. Concentrations as high as 25 mg/kg fresh weight, have been observed but the average values do not exceed the EEC quality objective of 0.3 mg/kg. (Lantz-PTT)
W86-05366

BACILLUS PHAGES AS TRACERS OF WATER MOVEMENT,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.

R. N. Purdy, B. N. Dancer, M. J. Day, and D. J. Stickler.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 149-153, 1986. 1 fig, 3 tab, 14 ref.

Descriptors: *Bacillus phages, *Tracers, *Flow profiles, *Bioindicators, Bacteria, Path of pollutants, Wastewater, Viruses, Culturing techniques, Escherichia coli, Filtration.

Vegetative bacterial cells, bacterial spores and bacteria viruses have all been used to trace the dispersion of sewage from coastal outfalls. The phages are considered to have advantages over other microbial tracers in that they can be prepared in high titres (10 to the 13th particles/ml) and can be assayed in less than 8 hours. Furthermore, because these viruses only infect bacteria they represent no health risk. This paper describes the selection of five Bacillus phages for their potential use as tracers. Each phage has a clear plaque morphology, and specific hosts have been shown to be suitable for use as tracers of water movement, thereby enabling them to be used in studies where concurrent labelling of several sources is required. The stability of these phages in comparison to that of E. coli has been established in sea water. These data could be used in the analysis of dispersion data to predict E. coli concentrations at sites where changes in sewage disposal policy might be under consideration. A simple and robust filtration method requiring no complex or expensive equipment, has been devised which permits the efficient recovery and enumeration of phage tracers from 100 mg water. The increased sensitivity of the membrane filtration technique allows large scale tracer studies to be performed on phage preparations from lysates of less than 10 L of infected host bacterial culture. (Lantz-PTT)
W86-05367

MERCURY CONTAMINATION IN COMPONENTS OF AN ESTUARINE ECOSYSTEM,
Forth River Purification Board, Queensferry (Scotland).
For primary bibliographic entry see Field 5C.
W86-05369

MERSEY ESTUARY (U.K.) BIRD MORTALITIES - CAUSES, CONSEQUENCES AND CORRECTIVES,
North West Water Authority, Warrington (England).
For primary bibliographic entry see Field 5C.
W86-05370

CHEMICAL FORMS OF ARSENIC IN MARINE ORGANISMS, WITH EMPHASIS ON HEMIFUSUS SPECIES,
Environmental Protection Agency, Kowloon (Hong Kong).
D. J. H. Phillips, and M. H. Depledge.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 213-222, 1986. 5 fig, 1 tab, 68 ref.

Descriptors: *Arsenic, *Marine animals, *Chemical composition, Spindle shells, Tissue analysis, Chemical analysis, Gastropods, Chemical reactions, Algae, Public health.

Investigations of arsenic in spindle shells (Hemifusus tuba and H. ternatanus) in Hong Kong, have revealed moderate to high concentrations of total arsenic in soft tissues. Levels of inorganic arsenic vary considerably between the tissues in these gastropods, being very high in the gill, but much lower in the foot. The significance of these data in terms of public health is discussed. In addition, the uptake of inorganic arsenic from solution by H. tuba is described. The importance of the precise chemical speciation of arsenic in marine biota is emphasized, and the forms of the element reported to date in marine environments are reviewed. A novel hypothesis is described to account for the derivation of all forms of arsenic found in marine organisms to the present. It is proposed that each of these arsenic-containing compounds is produced by a single anabolic/catabolic pathway concerned with the synthesis and turnover of phosphatidylcholine. This phospholipid (which is a major component of cell membranes) may be synthesized by most organisms either directly from choline or by the (triple) methylation of phosphatidylethanolamine. If both the initial substrates of these pathways (choline and ethanolamine) were to exist in biota as their arsenic analogues (As(+) replacing N), the biosynthesis would proceed. Such a proposal accounts not only for the reported existence of arsenolipids, arsenocholine and arsenobetaine, but might also explain the derivation of arsenosugars in algae. The methylation of phosphatidylethanolamine is a 3-stage process involving S-adenosylmethionine (SAM) as a methyl group donor and the enzyme phosphatidylethanolamine methyltransferase. It is hypothesized that in algae, the presence of the arsenic atom in the substrate analogue causes steric interference between the second and third methylation steps. As a result, the reaction could proceed by attack of the S-CH2 bond between the methionine and the sugar moieties, rather than the S-CH3 bond normally attacked. This would give rise to a complex intermediate. The relationship of this intermediate to documented arseno-sugars is apparent. Oxidation of the diacylglycerophosphate-containing and replacement of the adenine moiety by alternative groups (related to substrates used in phospholipid biosynthesis) would give rise to the arseno-sugars as reported in kelp and giant clams. (Lantz-PTT)
W86-05374

TRANSPORT AND WATER QUALITY MODELLING IN THE SOUTHERN NORTH SEA IN RELATION TO COASTAL POLLUTION RESEARCH AND CONTROL,
Waterloopkundig Lab. te Delft (Netherlands).
J. A. van Pagee, H. Gerritsen, and W. P. M. de Ruijter.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 245-256, 1986. 11 fig, 1 tab, 10 ref.

Descriptors: *Water quality, *Model studies, *North Sea, *Coastal zone management, Heavy metals, Nutrients, Marine environments, Distribution pattern, West Germany, Holland, Pollution load, Rhine River, Weser River, Elbe River, Mathematical models, Cadmium, Mercury, Copper, Lead, Zinc, Chromium.

Mathematical modelling techniques are used to quantify the transport of pollutants originating from various inputs in the southern part of the North Sea. Special attention was given to the anthropogenic increase in local concentrations of nutrients (N,P) and heavy metals (Cd, Hg, Cu, Pb, Zn, Cr), and their potential impact on marine organisms. A depth-averaged hydrodynamic model is used to calculate tidal and wind driven velocities and water levels. By averaging, residual flows are calculated, forming the basis for advective transports in a water quality model. Dispersive transports are derived from a comparison of simulated and observed salinity distributions. Water mass distributions and age functions for various inflowing water types are determined with the model. Transports of nutrients and heavy metals in the southern part of the North Sea are calculated using annual pollution inputs for 1980. Although interactions with bottom sediments are not considered, the calculated and measured concentrations show good similarities. The water quality in the Dutch coastal zone and German Bight area is shown to be highly determined by local pollution loads from the rivers Rhine, Weser and Elbe, respectively. Comparison of simulated concentrations for 1980 with those resulting from simulations with estimated natural river inputs, shows that more than 50% nutrients and heavy metal concentrations originate from human activities in large coastal zone areas. From toxicological information and standards, it is concluded that Cd, Hg, and Cu are substances that need special attention in pollution research and control for the Dutch coastal waters. (Lantz-PTT)
W86-05377

STEADY STATE AND TIME-VARYING WATER QUALITY MODELS FOR THE HOOGHLY ESTUARY, INDIA,
Calcutta Metropolitan Development Authority (India).
S. K. Bose, and B. K. Dutta.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 257-265, 1986. 4 fig, 13 ref.

Descriptors: *Water quality, *Model studies, *Hooghly Estuary, *India, Time series analysis, Channel flow, Biological oxygen demand, Dissolved oxygen, Estuaries.

Steady state and time-varying water quality models for the Hooghly estuary have been developed for the 92.5 km stretch from Tribeni to Mayapur. An hydraulic model of the estuary was previously developed in this connection, based on a simulated channel of trapezoidal cross-section, gradually increasing downstream, and with uniform ground slope. The estuary has also been assumed to be sectionally homogeneous in each of the thirty-seven sections. The advection-diffusion equations have been numerically integrated to compute the instantaneous and time-averaged distribution of biological oxygen demand (BOD) and dissolved oxygen (DO). The monthly averages of the quantities over the year have also been determined. The different system parameters have been estimated using available equations and correlations. The computed results show that the BOD level lies in the range 0.75 - 3 mg/L, and the range of DO was found to be 5 - 7.5 mg/L. The computed results are generally in agreement with the field data available. Thus computations based on simulated channel characteristics may be useful for prediction of water quality. However, the model needs to be tested with more field data in other seasons before it is put to use in any decision-making process. (Lantz-PTT)
W86-05378

DISTRIBUTION OF HEAVY METALS IN WASTE DRILLING FLUIDS UNDER CONDITIONS OF CHANGING PH,
Shell Development Co., Houston, TX.
G. M. Deeley, and L. W. Canter.
Journal of Environmental Quality JEVQAA, Vol. 15, No. 2, p 108-112, April-June 1986. 6 tab, 25 ref.

Descriptors: *Heavy metals, *Drilling fluids, *Hydrogen ion concentration, Distribution patterns, Arsenic, Barium, Chromium, Lead, Oil wastes, Chemical analysis, Drilling, Waste disposal.

A laboratory study was conducted to determine the influence of pH on the distribution of arsenic (As), barium (Ba), chromium (Cr), and lead (Pb) in three different oil and gas well drilling fluid wastes. Samples were obtained from disposal pits and equilibrated in the laboratory under controlled conditions of pH. A sequential extraction procedure was then used to fractionate the selected elements into the fractions of aqueous, KNO2-extractable, H2O3-extractable, H2O-extractable, NaOH-extractable, EDTA-extractable, and HNO3-extractable phases. The chemical fractions present at each pH were then compared, providing insight into the potential of mobilization of As, Ba, Cr, and Pb into ground- or surface waters. The majority of each of the elements studied was found in the NaOH-extractable, EDTA-extractable or HNO3-extractable fractions except for one waste which contained a major portion of the total barium in the KNO3-extractable fraction. Generally, a decrease in pH caused a shift from the more stable HNO3-extractable fraction to the less stable EDTA-extractable, NaOH-extractable, or KNO3-extractable fractions. In no case was there a substantial release to the aqueous phase with changing pH. The significance of these results is that with pH changes to be expected in the natural environment, there is not likely to be a major release of As, Ba, Cr, and Pb from drilling fluid waste disposal pits. The lower pH values (<4) which might produce some impact, are unlikely to occur in the environment because the wastes themselves have a large neutralizing capacity. (Lantz-PTT)
W86-05384

PERMETHRIN WASHOFF FROM COTTON PLANTS BY SIMULATED RAINFALL,
Agricultural Research Service, Baton Rouge, LA.
G. H. Willis, L. L. McDowell, S. Smith, and L. M. Southwick.

Journal of Environmental Quality JEVQAA, Vol. 15, No. 2, p 116-120, April-June 1986. 3 fig, 5 tab, 11 ref.

Descriptors: *Permethrin, *Washoff, *Simulated rainfall, *Cotton plants, *Pesticides, *Path of pollutants, Suspended sediments, Agricultural runoff, Rainfall intensity, Rainfall rate.

The development of models for predicting amounts of pesticide transported in runoff and suspended sediment from agricultural land to aquatic habitats has been hampered for foliarly-applied pesticides a lack of knowledge about the processes of pesticide washoff from plants by rainfall. A multiple-intensity rainfall simulator was used to determine the effects of rain intensity and amount on permethrin ((3-phenoxyphenyl)methyl(+)cis, trans-3-(2,2-dichloroethenyl)-2,2-dimethylcyclopropanecarboxylate) concentrations and amounts washed from mature cotton (Gossypium hirsutum L.) plants. Permethrin concentration in plant washoff was independent of rain intensity when 25 mm of simulated rain was applied at 6.6, 13.0, 25.7, and 51.3 mm/h, 2 h after permethrin was applied at 0.224 kg/ha. Concentrations were less when the same amount of simulated rain was applied at 106.4 mm/h. Permethrin concentrations in plant washoff decreased rapidly during the early phases of washoff. About 35% of the permethrin load on the plants 2 h after application was washed off by 25 mm of rain. An additional 76 mm of rain removed only 11% more of the permethrin from the plants. Rainfall amount had greater influence than rainfall intensity on the amount of permethrin washed from the cotton plants. (Lantz-PTT)
W86-05385

POTASSIUM LOSSES IN RUNOFF AND DRAINAGE WATERS FROM CROPPED, LARGE-SCALE LYSIMETERS,

Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.
R. L. Jones, and T. D. Hinesly.
Journal of Environmental Quality JEVQAA, Vol. 15, No. 2, p 137-140, April-June 1986. 4 tab, 10 ref.

Descriptors: *Potassium, *Agricultural runoff, *Digested sludge, *Drainage water, Lysimeters, Wastewater farming, Irrigation, Corn plants.

Losses of total recoverable potassium (K) were measured in runoff and percolate waters from field lysimeter plots of Blount silt loam (fine, illitic, mesic Aeric Ochraqualfs) from May 1972 through April 1974. Six plots were irrigated annually with digested sewage sludge, while another six plots which had been treated with a complete fertilizer were irrigated with well water. Each year all plots were fertilized with KCl in amounts that supplied 269 kg K/ha prior to the preparation of a seedbed for corn (Zea mays L.). For the 2 years of record, combined K losses in runoff and drainage waters from sludge-treated plots averaged 41.9 and 8.2 kg/ha, respectively. For the same years, losses from plots irrigated with well water averaged 23.3 and 10.5 mg K/ha in runoff and drainage waters, respectively. The differences between treatments within each year were not significant between years within treatment. Large K losses occurred in runoff during heavy summer rains and in winter when rapid snow melt and rain events took place. Consistently higher K losses were observed in drainage waters during late winter and spring periods for both years. Median concentrations of total recoverable K in runoff and drainage waters from sludge-treated plots were, respectively, 7.5 and 4.8 mg/L in the first year, and 7.8 and 2.4 mg/L during the second year. Respective data for water-irrigated lysimeters were 6.0 and 2.9 mg K/L in 1972 through 1973, and 7.5 and 1.8 mg K/L in 1973 through 1974. Potassium losses were small when compared to amounts supplied as constituents of sludge and fertilizer, and to soil levels of total native and acid-extractable K. In the drier year, 1973 through 1974, total K losses in runoff and drainage from plots receiving conventional fertilizers were similar to weights of K removed in grain. (Author's abstract)
W86-05388

COMPARISON OF METHODS FOR ESTIMATING SULFATE EXPORT FROM A FORESTED WATERSHED,

Pennsylvania State Univ., University Park. School of Forest Resources.
M. S. Dann, J. A. Lynch, and E. S. Corbett.
Journal of Environmental Quality JEVQAA, Vol. 15, No. 2, p 140-145, April-June 1986. 1 fig, 6 tab, 17 ref.

Descriptors: *Sulfates, *Solute transport, *Forest watersheds, *Estimating equations, Model studies, Pennsylvania, Flow pattern, Regression analysis, Statistical analysis, Ion transport, Nutrient removal.

Seven methods of estimating sulfate export from a forested watershed in central Pennsylvania were compared. One method involved simple linear regression of discharge and concentration data, two methods were based on regression models in which the concentration data were stratified by flow frequency or duration, two methods weighted the mean concentration by discharge, one method used a simple unweighted mean concentration, and one weighted export according to the length of the sampling period interval. The regression models produced the highest export estimates but were considered statistically invalid because the data set did not adhere to the statistical requirements of independence, normality, and linearity. Weighted and unweighted mean concentration methods gave the lowest estimates of export because they gave less emphasis to high flows during which the majority of sulfate was exported from the watershed. The period-weighted method gave intermediate to high export estimates because it took into consideration the large export of sulfate during high flows, and appeared to offer the best estimate of sulfate export from the watershed studied within the conditions and limitations of the data set. Although limited to sulfate export from a forested watershed, these results would appear to be applicable to any ion, particularly if the solute concentration of the ion is flow related. (Lantz-PTT)
W86-05389

ONE-DIMENSIONAL MODEL OF CHEMICAL DIFFUSION AND SORPTION IN SATURATED SOIL AND AQUATIC SYSTEMS,

Morrison-Knudsen Engineers, Inc., Denver, CO.
D. L. Corwin.
Journal of Environmental Quality JEVQAA, Vol. 15, No. 2, p 173-182, April-June 1986. 9 fig, 2 tab, 27 ref.

Descriptors: *Models studies, *Chemical diffusion, *Sorption, *Saturated soils, *Path of pollutants, Aquatic environment, Adsorption, Chemical reactions, Physicochemical properties, Simulation analysis, Solute transport, Boron, Diquat, Bromacil.

A one-dimensional model for chemical diffusion in saturated porous media systems is presented. The model provides for adsorption-desorption reactions, either Freundlich or Langmuir, and both solid and liquid phase first-order chemical degradation under isothermal, water-saturated conditions. Finite-difference solutions to the model which simulate the one-dimensional diffusion of an inorganic/organic chemical from the sediment of an aquatic system into the overlying water are provided for a variety of initial and boundary conditions. Analogous applications to flow processes within a structured soil can be made for the diffusion of an inorganic/organic chemical into and out of saturated planar soil aggregates. The initial and boundary conditions are designed to simulate a variety of aquatic situations: ponds, lakes, streams, rivers and oceans. Both explicit and implicit finite-difference schemes are presented for four different saturated systems. The model provides a means of assessing the physicochemical dynamics of chemical-sediment-water interactions and of assessing the pollution potential of chemicals to plants and animals as determined by their propensity to migrate to different compartments of the aquatic environment. The models can also determine the influence of diffusion processes within planar soil aggregates upon solute flow in saturated structured soils. Various simulations are presented for boron (B), diquat (1,1'-ethylene-2,2'dipyridilium dibromide), and bromacil (5-bromo-3-sec-butyl-6-methyluracil). (Lantz-PTT)
W86-05390

PHOTOCHEMICAL AND MICROBIAL DEGRADATION OF 2,4,5-TRICHLOROANILINE IN A FRESHWATER LAKE,

Georgia Univ., Athens. Dept. of Microbiology.
H. -M. Hwang, R. E. Hodson, and R. F. Lee.
Applied and Environmental Microbiology, Vol. 50, No. 5, p 1177-1180, November 1985. 4 tab, 22 ref.

Descriptors: *Biodegradation, *Path of pollutants, *Fate of pollutants, *Chlorinated hydrocarbons, *Microbial degradation, *Photochemical degradation, *Eutrophic lakes, Lakes, Georgia, Algae, Bacteria, Mineralization.

Surface waters from a eutrophic lake, Lago Lake, in northern Georgia were incubated with 14-C labeled 2,4,5-trichloroaniline to study the disappearance of the parent compound and production of 14-CO2. There was no degradation of the compound in the dark. Under 12 h of sunlight and 12 h of darkness, 28% of the trichloroaniline was degraded. Mineralization after 24 h in poisoned (abiotic; 1 mg/l mercuric chloride added) and untreated lake water was 5.5 and 6.8% respectively. Thus, 81% of the mineralization was attributable to photochemical processes, and 19% was attributable to microbial processes. Most biological mineralization was due to microbes of bacterial size (<1.0 micrometers). Approximately 90% of the trichloroaniline bioaccumulated was associated with organisms larger than 1.0 micrometers, e.g., algae. When algae were removed by filtration, the amount of trichloroaniline mineralized increased to 9.4%, compared with 6.8% in the presence of algae. The excretion of organic compounds by algae may have inhibited bacterial mineralization of photoproducts. These results indicate that microbial degradation kinetics and rates of other physical and chemical processes must be assessed together to predict the persistence of organic compounds in aquatic environments. (Peters-PTT)
W86-05392

BACTERIAL PROFILE OF PETROCHEMICAL INDUSTRY EFFLUENTS,

Baroda Univ. (India). Dept. of Biochemistry.
For primary bibliographic entry see Field 5D.
W86-05393

ROLE OF SPECIATION IN MERCURY METHYLATION IN SEDIMENTS AND WATER,

Leicester Polytechnic (England). School of Chemistry.
P. J. Craig, and P. A. Moreton.
Environmental Pollution (Series B), Vol. 10, No. 1, p 141-158, 1985. 1 fig, 5 tab, 20 ref.

Descriptors: *Mercury, *Speciation, *Path of pollutants, *Estuaries, *Sediments, Methylmercury, Methylation, Kinetics, Chemical reactions, Solubility.

Nine inorganic mercury (II) complexes were prepared and reacted with a series of methyl donors in abiotic reactions in distilled water to determine inherent methylation capacity. These complexes were also incubated in sediments capable of methylation to determine the role of mercury configuration and speciation in the environmental production of methyl mercury. The rate and extent of the methylation of inorganic mercury depended markedly on the chemical speciation of the mercury and the methylating agent. The presence of mercury (II) - chlorine covalent bonding had an inhibitory effect on methylation by methyl cobalamin (CH3CoB12) and in natural sediments. The role of radical and carbonium ion methylation mechanisms was also investigated. In a typical estuarine sediment the extent of mercury methylation is as follows: Hg(OAc)2 > Hg(cyst)2 > Hg(cyst)(Hcyst)Cl > Hg(meth)2(2+) > Hg(eth)2(2+) > Hg(Hcyst)Cl2 > (HgCl2)2pen, where OAc = acetate, Hcyst = cysteine, meth = methionine, eth = ethionine and pen = penicillamine. This is consistent with mercury methylation

arising by attack of a methyl carbanion (CH3(-) on inorganic mercury (II) ions derived by microbial breakdown of the original mercury compounds added. (Peters-PTT)
W86-05395

HEADWATER STREAM LOSSES OF NITROGEN FROM TWO COASTAL PLAIN WATERSHEDS,
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
T. C. Jacobs, and J. W. Gilliam.
Journal of Environmental Quality, Vol. 14, No. 4, p 467-472, October-December 1985. 3 fig, 5 tab, 23 ref.

Descriptors: *Denitrification, *Agricultural watersheds, *Path of pollutants, *Coastal plains, *Nitrogen compounds, Soil solution, Fertilizers, North Carolina, Eutrophication, Nonpoint pollution sources, Flood plain, Headwaters, Forest soils, Surface runoff, Oxidation-reduction potential.

Nitrogen concentrations and water flow were measured for a 3-yr period from two watersheds of the Atlantic Coastal Plain in North Carolina to assess sinks for NO3-N. From the Middle Coastal Plain watershed with 1299 ha of predominantly well- to moderately well-drained soils, the losses of NO3-N and total N in surface drainage water were 2.5 and 4.5 kg/ha/yr, repectively. The Lower Coastal Plain watershed with 6998 ha of somewhat poorly- to poorly-drained soils had NO3-N and total N losses of 0.5 and 2.5 kg/ha/yr, respectively. These values were much lower than expected based on agricultural production, fertilizer used, and crop efficiency. Denitrification between the field and stream is the primary reason for these low values. However, the concentrations of NO3-N in streams near the field outlets decreased significantly as N enriched water moved through the transport system. Comparing changes in nitrate and chloride concentrations and the reducing oxidation-reduction potential in the stream and floodplain sediments suggest denitrification as the loss mechanism in the stream transport system. Ostensibly the stream is responsible for the loss rather than the riparian area; however, the area inundated by the stream is small compared to the flood plain. The Middle and Lower Coastal Plain watersheds have 2.5 and 94 ha inundated by the stream while confined to the channel, but in a moderate flood, these values increase to 20 and 250 ha, respectively. While instream losses of NO3-N are important in this region to maintain water quality, they are not sufficient to completely counter heavy loading by nonpoint sources. (Author's abstract)
W86-05398

ORGANIC MICROPOLLUTANTS AND THE PROTECTION OF WATER SUPPLIES,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
R. Perry, and A. E. McIntyre.
Effluent and Water Treatment Journal, Vol. 26, No. 1, p 15-18, January 1986. 3 tab, 14 ref.

Descriptors: *Organic matter, *Environmental protection, *Groundwater protection, *Micropollutants, *Water reuse, *Water treatment, Groundwater pollution, Water pollution control, Surface water, Pollutants.

Contamination of surface and ground waters is briefly reviewed and appropriate treatment technology for the production of acceptable quality drinking water was considered. Health risks were evaluated in a comparison between surface water with ground water, and chlorinated water compared with non-chlorinated water. The presence of trihalomethane (THM) in drinking water was also evaluated in terms of potential risk to health. Both immediate and remote hydrological cycle inputs were found to be of concern. In the latter case, on-site treatment of industrial effluents prior to discharge to foul sewers or surface waters was found to be the most desirable option to effect protection of re-use rivers. In the former case, it was found to be important that progress in developing new water treatment processes is matched by progress in the perception of problems and the need to apply new technology. (Master-PTT)
W86-05405

OCCURENCE OF RADIOACTIVITY IN PUBLIC WATER SUPPLIES IN THE UNITED STATES,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
C. T. Hess, J. Michel, T. R. Horton, H. M. Prichard, and W. A. Coniglio.
Health Physics, Vol. 48, No. 5, p 553-586, May 1986. 8 fig, 17 tab, 91 ref.

Descriptors: *Water supply, *Radioactivity, *Groundwater, *Geohydrology, *Surface water, *Radon, United States, Cancer, Geologic formations, Radium, Radium isotopes, Uranium, Uranium isotopes, Radioisotopes, Surface water records, Geology, Public health, Surveys, Distribution patterns.

State and national surveys of radionuclide levels in public water supplies are reviewed, with emphasis on the influence of geological setting (Rock type and nature of the ground water flow system). More than 51,000 measurements for gross alpha-particle and/or Ra activity; 89,000 measurements for U; and 9,000 measurements for Rn were considered in terms of 11 geological provinces comprising the contiguous United States. The highest level of Ra were found in the Upper Coastal Plain, Glaciated Central Platform, and Colorado Plateau provinces. The highest levels of U were in the Colorado Plateau, West Central Platform, and Rocky Mountains. The highest levels of Rn were in the New England and Appalacian Highlands/Piedmont provinces. Surface waters had low levels of Ra and Rn compared to groundwater, but comparable levels of U. Utilities serving small populations had the highest concentrations of earth radionuclide and also the least sampling records. Risk estimates are presented in terms of excess fatal cancers per 70.7-year lifetime. A principle conclusion is that geological setting can serve as an indication of the need for careful monitoring of radioactivity in public water supplies. Specific conclusions regarding distribution and transport and recommendations on regulation and monitoring are presented. (Robinson-PTT)
W86-05407

DISTRIBUTION OF ACID DEPOSITION IN GERMANY,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
P. Valenta, V. D. Nguyen, F. Wagner, and H. W. Nurnberg.
Experientia EXPEAM, Vol. 42, No. 4, p 330-339, April 1986. 11 fig, 5 tab, 34 ref.

Descriptors: *Acid rain, *Hydrogen ion concentration, *Sulfuric acid, Germany, Ruhr, Sampling network, Acid distribution, Acid deposition, Precipitation amount, Rain, Snow, Wet deposition.

The distribution of acid deposition by atmospheric precipitations in the Federal Republic of Germany is discussed, based on investigations of the wet H(+)-deposition during 1980-1984, using a network of 16 automated samplers located in various categories of ecosystems. An increase of the H(+)-concentration and H(+)-deposition values was observed from 1980 onwards with a maximum in 1981 and a slow decrease in the next two years. In the more significantly polluted regions, the removal of H(+)-ions by wash-out is more effective than in the rural regions. In the Ruhr region, the hydrogen ion concentration is shifted to more acid values, due to the wash-out of acid particles and aerosols. In regions with metallurgical industry, the hydrogen ion concentration is shifted to more alkaline values due to the wash-out of alkaline particles. The free acid in rain and snow is rather uniformly distributed over the whole area as a result of mesoscalic transport of the acid precursors SO2 and NOx and the concomitant formation of acid in the cloud droplets leading to acid deposition by rain-out. (Peters-PTT)
W86-05413

ATMOSPHERIC AMMONIUM SULPHATE DEPOSITION AND ITS ROLE IN THE ACIDIFICATION AND NITROGEN ENRICHMENT OF POORLY BUFFERED AQUATIC SYSTEMS,
Katholieke Univ. Nijmegen (Netherlands). Lab. of Aquatic Ecology.
J. A. A. R. Schuurkes.
Experientia EXPEAM, Vol. 42, No. 4, p 351-357, April 15, 1986. 5 fig, 6 tab, 31 ref.

Descriptors: *Acid rain, *Ammonium, *Hydrogen ion concentration, Norway, Sweden, Denmark, Scotland, Belgium, Germany, Britain, Europe, Nitrogen, Sulphuric acid, Nitric acid, Manure, Cropland, Air pollution, Cattle.

Acidification of aquatic environments is one of the phenomena linked to the problems of acid precipitation. An analysis of the hydrogen ion concentration in the Netherlands revealed that most of the acidic waters are in the middle, southern, and eastern parts of the country. In Scandinavian countries, it is assumed that acidification is the result of increased deposition of strong acids like sulphuric and nitric acid. In the rainwater of northern Britain and Norway, there is a correlation between the H(+) concentration and the excess of sulfate ions. The atmospheric transport of NH(3+), emitted from breeding farms and strongly manured cropland, causes severe loading of neighboring nonagricultural environments. The wet deposition of ammonium sulphate is enhanced, while the hydrogen ion concentration of rainwater is only slightly acidic. Due to the variation of gaseous pollutants over the Netherlands large differences are noticed in the relative contribution of each acidifying component in rainwater. In areas with high atmospheric NH(3) concentrations, ammonium sulfate contributes the major part to the potential acidifying influence of wet deposition. Preliminary experiments show a casual relation between ammonium sulfate and water acidification, ammonium enrichment and the expansion of ammonium tolerant shore macrophytes. In the Netherlands, the deposition of NH(3) and SO(2) derived compounds has provided the major contribution to acidification and N-enrichment of hydrologically isolated, poorly buffered pools. (Peters-PTT)
W86-05414

EFFECTS OF ACID DEPOSITION ON CROPS AND FORESTS,
Imperial Coll. of Science and Technology, London (England). Dept. of Pure and Applied Biology.
J. N. B. Bell.
Experientia EXPEAM, Vol. 42, No. 4, p 363-371, April 15, 1986. 5 fig, 4 tab, 82 ref.

Descriptors: *Acid rain, *Forests, *Cropland, *Sulfur dioxide, *Nitrogen oxide, Pine trees, Germany, England, Ohio, Pennsylvania, Tree canopy, Beans, Carrots, Maize, Green pepper, Strawberry, Alfalfa, Mustard green, Species diversity, Hardwood, Conifers, Soil types.

Acid deposition includes the gases, sulfur dioxide and nitrogen oxides, and their derivative acids which are dissolved in various forms of precipitation. The effects of both dry and wet deposition on crops and forests are reviewed, including interactions between these two categories of pollutant. The effects of SO2 and NO2 on conifers (Pinus sylvestris, Scots pine) were studied in the Ruhr region of Germany. This species was absent from sites where the mean annual SO2 concentration exceeded 75 ppb. A similar investigation in industrial regions of the southern Pennine hills in northern England found a significant negative correlation between mean winter SO2 levels and the frequency of occurrence of P. sylvestris. It appears that hardwoods are less susceptible to SO2 than are conifers. A study of changes in species composition of a forest subjected to different levels of SO2 and NOx in the Ohio River Valley suggested that air pollution caused both primary and secondary effects; the tree canopy showed increased mortality, but this permitted an increase in sub-canopy and shrub species density, which in turn suppressed diversity in the herb layer. A similar study in Pennsylvania showed that greater adverse effects occurred on the sub-canopy, shrub, and herb layers. The net response of agricultural crops to

acidic deposition is the result of the interaction between the positive effects of sulphur and nitrogen fertilization, the negative effects of acidity, and the interaction between these factors and other environmental conditions such as soil type and the presence of other pollutants. (Peters-PTT)
W86-05415

EFFECT OF AIRBORNE SULPHUR AND NITROGEN DEPOSITION ON AQUATIC AND TERRESTRIAL HEATHLAND VEGETATION,
Katholieke Univ. Nijmegen (Netherlands). Lab. of Aquatic Ecology.
J. G. M. Roelofs.
Experientia EXPEAM, Vol. 42, No. 4, p 372-377, April 15, 1986. 1 fig, 6 tab, 40 ref.

Descriptors: *Acid rain, *Aquatic vegetation, *Ammonium, *Pine trees, *Sulphur, *Nitrogen, Netherlands, Heather, Grass, Oligotrophic lakes, Carbon dioxide, Peat, Pine trees, Conifers, Cattle, Nutrients, Carbonate.

Heathlands and peatlands are often neglected areas in the acid rain research, probably due to the low economic value of these areas. During the last decades, dramatic changes have taken place in the plant communities of these areas. The number of moorland pools and small lakes in which Littorellion species occur has declined; heathlands have turned into grasslands and particularly in areas with intensive stockbreeding, the condition of the pine forests is bad. The change from heather into grass dominated heathlands appeared to be caused by the high atmospheric nitrogen enrichment. Acidification of oligotrophic, poorly buffered pools in heathland areas, results in the disappearance of all submerged plant species, caused by the too low CO2 levels in the water layer. The vitality of the pine forests decreases; apart from the premature shedding of needles as a result of nutrient deficiencies, they become more susceptible to secondary stress factors such as NH3, O3, drought and fungal diseases. Acidification of poorly buffed heathland soils as a result of acid or acidifying precipitation leads to a strong decline in the number of plant species. Acidification of a water body above a carbonate-free sediment leads to disappearance of all submerged macrophytes due to lack of carbon dioxide. Acidification of a water body above a sediment containing little carbonate, as a result of ammonium-containing acidifying precipitation, leads to a suppression of the isoetid plant community by luxuriant growth of Juncus bulbosus and/or Sphagnum species as a result of increased carbon dioxide and ammonium levels in the water layer. Airborne ammonium deposition on acidic heathland soils leads to a succession from heather-dominated into grass-dominated heathlands. (Peters-PTT)
W86-05416

5C. Effects Of Pollution

FROM SWAMP TO LAKE: RECENT CHANGES IN A LOWLAND TROPICAL SWAMP,
Papua New Guinea Univ., Port Moresby. Dept. of Biology.
P. L. Osborne, and N. V. C. Polunin.
Journal of Ecology, Vol. 74, No. 1, p 197-210, March 1986. 9 fig, 19 ref.

Descriptors: *Lakes, *Swamps, *Papua New Guinea, *Waigani Lake, Sediment profiles, Organic matter, Water content, Sediment cores, Phosphorus, Nitrogen, Diatom stratigraphy, Aquatic plants.

Sediment cores from Waigani Lake, close to Port Moresby, Papua New Guinea, were analyzed to relate the sediment record to the vegetation changes known to have taken place and to assess reasons for the changes. Aerial photographs show freshwater vegetation changes since the 1950s. Records of diatom assemblages and plant seeds in sediment cores confirm that the lake was at one time dominated by a mixed emergent swamp, that this was replaced by floating-leaved plants and that the latter were replaced by the present open water. This is characterized as a partial reversal of a hydrosere. Marked variations in organic and moisture content, and phaeopigments, total nitrogen and total phosphorus concentrations with depth in the sediment cores indicate substantial changes in the aquatic environment. Increases in both nitrogen and phosphorus concentrations closely predate the major vegetation changes. Water level change is an obvious cause but cannot explain all features of the vegetational changes observed. Evidence is presented to show that nutrient enrichment could have been influential. These two influences cannot be separated easily in the present record because the same cause, increase in sewage and urban runoff with human development in the catchment, has led to both. (Peters-PTT)
W86-04697

NITROGEN CYCLING IN A FRESHWATER MARSH OF PANICUM HEMITOMON ON THE DELTAIC PLAIN OF THE MISSISSIPPI RIVER,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 2H.
W86-04698

WATER RELATIONS OF CHROMIUM VI TREATED BUSH BEAN PLANTS (PHASEOLUS VULGARIS) L. CV. CONTENDER) UNDER BOTH NORMAL AND WATER STRESS CONDITIONS,
Universidad Autonoma de Barcelona (Spain). Faculty of Sciences.
J. Barcelo, C. Poschenrieder, and B. Gunse.
Journal of Experimental Botany, Vol. 37, No. 175, p 178-187, February 1986. 3 fig, 5 tab, 34 ref.

Descriptors: *Water pollution effects, *Water stress, *Beans, *Plant water potential, *Chromium, Water potentials, Solute potential, Agriculture, Leaves, Turgidity, Plant Physiology, Drought.

The effect of different Cr VI concentrations on leaf water potential, solute potential, turgor potential and relative water content of bush bean plants was studied in the presence of an adequate water supply and under water stress conditions. Plants were grown on perlite with nutrient solution containing 0, 1.0, 2.5, or 10.0 micrograms per cc Cr. The effect of Cr on water relations was concentration dependent, and primary and first trifoliate leaves were affected differently. The growth reducing concentrations of Cr generally decreased leaf water potential and solute potential and increased turgor potential in primary leaves. The 1.0 microgram per cc Cr treatment did not affect growth, but altered water relations substantially: in primary leaves, leaf water potential and turgor potential were increased and solute potential decreased, while in trifoliate leaves the effect was the opposite. All Cr treated plants resisted water stress for longer than control plants. The higher water stress resistance may be due to the lower solute potential, and to the increased cell wall elasticity observed in Cr VI treated plants. (Peters-PTT)
W86-04701

ACID RAIN - A FURTHER LOOK AT THE EVIDENCE,
For primary bibliographic entry see Field 5B.
W86-04704

SCREENING COMPLEX HAZARDOUS WASTES FOR MUTAGENIC ACTIVITY USING A MODIFIED VERSION OF THE TLC/SALMONELLA ASSAY,
Health Effects Research Lab., Research Triangle Park, NC. Genetic Bioassay Branch.
For primary bibliographic entry see Field 5A.
W86-04709

DETERGENT PHOSPHATE BANS AND EUTROPHICATION,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5G.
W86-04719

CADMIUM-BINDING PROTEIN (METALLOTHIONEIN) IN CARP,
Gifu Pharmaceutical Univ. (Japan). Dept. of Environmental Hygiene.
H. Kito, Y. Ose, and T. Sato.
Environmental Health Perspectives EVHPAZ, Vol. 65, p 117-124, March 1986. 2 tab, 8 fig, 28 ref.

Descriptors: *Carp, *Cadmium, *Protein, Metals, Metallothionein, Toxicity, Kidneys, Amino acids, Tolerance, Chromatography, Zinc, Tissue analysis, Detoxification.

The induction of metallothionein (MT) in carp exposed to Cd was studied. When carp were exposed to 5 and 30 ppm Cd in the water, the contents of low molecular weight Cd binding protein increased in the hepatopancreas, kidney, gills and gastrointestinal tract with the duration of exposure. This Cd-binding protein was purified from hepatopancreas, kidney, gill, and spleen of carp administered 2 mg/kg Cd as CdCl2, intraperitoneally for 6 days. Two Cd-binding proteins were separated by DEAE-Sephadex A-25 column chromatography. These proteins had Cd-mercaptide bonds, high cystein contents (29-34%), but no aromatic amino acids or histidine. From these characteristics the Cd-binding proteins were identified as MT. In the Cd-treated group (2 mg/kg IP daily for 3 days), MT was present in the nuclei, sinusoids, and extracellular space of hepatopancreas, in addition to the acinar cells. In the non-treated group, MT was present in the acinar cells of hepatopancrease and renal convoluted tubules. Carps were bred in 1 ppm Cd, 5 ppm Zn, and tap water for 14 days followed by transfer to a 15 ppm Cd solution for 18 hr. The survival ratio was highest in the Zn group followed by Cd-treated and control groups, indicating a development of tolerance to Cd toxicity after exposure to a lower concentration of Cd and Zn. The MT contents increased in hepatopancreas and kidney in the order: Zn>Cd>control group. (Peters-PTT)
W86-04757

COPPER-BINDING PROTEINS IN LIVER OF BLUEGILLS EXPOSED TO INCREASED SOLUBLE COPPER UNDER FIELD AND LABORATORY CONDITIONS,
Lawrence Livermore National Lab., CA. Environmental Sciences Div.
F. L. Harrison, and J. R. Lam.
Environmental Health Perspectives EVHPAZ, Vol. 65, p 125-132, March 1986. 1 tab, 5 fig, 50 ref.

Descriptors: *Bluegills, *Copper, *Proteins, *Toxicity, Detoxification, Metals, Hydrogen ion concentration, Livers, Cadmium, Zinc, Electric powerplants, Effluents, Mortality, Fish, Tissue analysis.

The quantities of copper associated with metalloproteins were determinedin the livers of bluegills exposed to different concentrations of soluble copper under field and laboratory conditions. The effect of the pH of the water on the amounts present and the distribution among metalloprotein fractions was assessed. Analyses were performed on bluegills collected from the impoundment of the H. B. Robinson Steam Electric Plant (Florence, SC) near the effluent discharge of the power plant, near the water intake in the cooling system, and from a control pond as well as on bluegills exposed under controlled laboratory conditions. Metalloproteins were separated into low molecular weight (LMW), intermediate molecular weight (IMW) and high molecular weight (HMW) fractions by using high-performance liquid chromatography. In the field-exposed bluegills, Cu concentrations in the LMW, IMW, and HMW fractions were highest in bluegills from the discharge site and lowest in those from the control pond. In the laboratory-exposed bluegills, Cu concentrations in the fractions increased with exposure concentration and time. Concentrations of Cu in the LMW protein fraction and pellet of bluegills exposed to 160 micrograms Cu/L appeared to plateau with long exposure times, whereas those in the HMW fraction continued to increase. Bluegills maintained in 80 micrograms Cu/L at pH 5.5 accumulated lower concentrations of Cu in the LMW and pellet fractions and higher amounts in the HMW than those maintained in 80 micrograms Cu/L at pH 7.0.

Mortality was dependent on exposure concentration and duration and was higher in bluegills maintained in water at pH 5.5 than at pH 7.0. (Peters-PTT)
W86-04758

CADMIUM ACCUMULATION AND PROTEIN BINDING PATTERNS IN TISSUES OF THE RAINBOW TROUT, SALMO GAIRDNERI,
University Coll., Cardiff (Wales). Dept. of Biochemistry.
J. Kay, D. G. Thomas, M. W. Brown, A. Cryer, and D. Shurben.
Environmental Health Perspectives EVHPAZ, Vol. 65, p 133-139, March 1986. 3 tab, 3 fig, 16 ref.

Descriptors: *Cadmium, *Trout, *Proteins, Toxicity, Body burden, Metallothionein, Detoxification, Metals, Chromatography, Liver, Kidneys, Gills, Zinc, Copper.

Rainbow trout and brown trout were exposed to environmentally relevant concentrations of cadmium by inhalation. A variety of concentrations and times of exposure were investigated and the accumulation of the metal in the tissues and organs of each species was determined. The gills, liver and kidney together accounted for 99% of the accumulated load of body cadmium in the fish. The cadmium in all three organs was bound by two low molecular weight proteins distinct in character from metallothionein. The isoforms of metallothionein were also present but were found to bind only zinc and copper. When trout were injected with cadmium intraperitoneally, most of the metal accumulated in the liver where it was sequestered by the two isoforms of metallothionein. Pre-exposure of the trout to either a low concentration of cadmium (for several months) or to an elevated concentration of zinc (for 5 days) allowed the animals to survive a subsequent exposure to a high, otherwise lethal concentration of cadmium. The proteins responsible for sequestration of the two metals were identified, but two different mechanisms seemed to be involved in the protection of the animals. (Peters-PTT)
W86-04759

TRANSITION METAL-BINDING PROTEINS FROM THREE CHESAPEAKE BAY FISH SPECIES,
Johns Hopkins Univ., Baltimore, MD. School of Hygiene and Public Health.
R. Andersen, J. Frazier, and P. C. Huang.
Environmental Health Perspectives EVHPAZ, Vol. 65, p 149-156, March 1986. 1 tab, 7 fig, 20 ref.

Descriptors: *Proteins, *Heavy metals, *Chesapeake Bay, *Fish, Cadmium, Copper, Zinc, Metal-binding, Catfish, Bass, Perch, Estuaries, Metallothionein, Liver, Chromatography, Tissue analysis, Electrochemistry, Detoxification.

Defense mechanisms against toxicity of metals, particularly transition IB and IIB metals, copper, zinc, and cadmium were studied in striped bass and other fish species. Similar binding proteins exist in the fish species examined. Their constitutive levels and inducibility differ, with striped bass showing only about 10% as much of this protein as white perch. Livers from freshly caught fish were extracted and chromatographed on Sephade G-75 to resolve metal binding protein (MBP) in the 5 to 20 kdalton range. Upon induction with cadmium, the total MBP content increased in both catfish and striped bass, with significant amounts of cadmium bound to the protein. In white perch, induction of MBPs with cadmium could not be demonstrated due to the large amount of constitutive Cu-BP present, although significant quantities of cadmium were bound to MBP. Electrochemical analysis of the MBPs by polarography indicated that the wave properties of the fish MBPs resemble those of rat metallothionein. These studies indicate that MBPs are present in estuarine fish from the Chesapeake Bay, concentrations of BMPs and their inducibility by exogenous cadmium vary with species, and fish MBPs may be related to mammalian metallothionein. (Peters-PTT)
W86-04760

NMR STUDIES OF CRAB AND PLAICE METALLOTHIONEINS,
Birkbeck Coll., London (England). Dept. of Chemistry.
D. P. Higham, J. K. Nicholson, J. Overnell, and P. J. Sadler.
Environmental Health Perspectives EVHPAZ, Vol. 65, p 157-165, March 1986. 1 tab, 9 fig, 16 ref.

Descriptors: *Crabs, Heavy metals, *Spectroscopy, Zinc, Detoxification, Copper, Cadmium, Fish, Metallothionein, Plaice, Nuclear magnetic resonance.

Cd113-NMR spectroscopy was used to characterize the cadmium-binding sites in crab metallothionein and proton NMR to investigate the reactivity of the bound metal ions towards EDTA. The kinetics of metal removal from proteins such as metallothionein by EDTA can be followed by measuring the intensities of the separate H1 resonances due to the metal-EDTA complexes. This approach allows simultaneous observations of changes in the proton NMR spectrum of the proteins themselves, which are related to changes in the tertiary structure of the protein. Metallothioneins isolated from the hepatopancreas of the edible crab and the plaices after cadmium injection are predominantly cadmium proteins containing only small amounts of zinc and traces of copper. Nearly all the zinc present in the protein was extracted by EDTA relatively rapidly, whereas only 10 to 20% of the total cadmium was removed in at least three steps. The total (Cd + Zn) metal removed at equilibrium was 1.2 to 1.8 gram-ions/mole protein. The coordination environments of the cadmium ions in crab metallothionein were investigated by using Cd113-NMR, and compared with Cd113-NMR spectra of rabbit liver and Scylla serrate metallothioneins. The metal binding sites in the crab metallothioneins are as closely related to the rabbit metallothionein as to that from the Scylla serrata. (Peter-PTT)
W86-04761

HG- AND CU-INDUCED HEPATOCELLULAR CHANGES IN THE MUMMICHOG, FUNDULUS HETEROCLITUS,
New Jersey Medical School, Newark. Dept. of Anatomy.
P. Weis, J. D. Bogden, and E. C. Enslee.
Environmental Health Perspectives EVHPAZ, Vol. 65, p 167-173, March 1986. 2 tab, 4 fig, 20 ref.

Descriptors: *Killifish, *Copper, *Mercury, Heavy metals, Methylmercury, New Jersey, Liver, Tissue analysis, Detoxification, Fish physiology.

A morphological approach was employed in the analysis of the liver of the mummichog in the course of examining possible mechanisms that enable the fish to tolerate heavy metals. The liver was chosen because it is the source of metal binding proteins. Less than 10% of the hepatic copper and none of the mercury were associated with metallothionein in the cytosol. Substantial differences were noted among liver of Hg(2+)- and Cu(2+)-treated and untreated fish. The changes observed may be related to the species' ability to tolerate these metals. In earlier work, protein analysis of liver indicated that most of the cytosolic Cu is bound to the sulfhydryl rich metallothionein, but that Hg is not associated with cytosolic proteins. Morphometric analysis indicates the Hg-treatment increases the lipid compartment of hepatocytes. This lipid increase is correlated with the Hg content of individual liver samples. Cu treatment causes a reduction in the lipid compartment, reduces cytoplasm in general, and an increased lysosome count. X-ray microanalysis locates Cu in secondary lysosomes, but not in other organelles. Results of treatment with both Hg(2+) and Cu(2+) are similar to those of Hg(2+) alone. Concentrations of Cu in liver varied too much to allow assessment of correlations with cytoplasmic changes. Usual mechanisms for handling toxic heavy metals include binding to metallothionein and sequestering in lysosomes. Fish, however, can methylate Hg. Increased cellular lipid may be a mechanism for sequestering the lipid-soluble methylmercury. (Peters-PTT)
W86-04762

METAL-BINDING PROTEINS AS METAL POLLUTION INDICATORS,
National Research Inst. for Oceanology, Stellenbosch (South Africa).
H. F. - K. O. Hennig.
Environmental Health Perspectives EVHPAZ, Vol. 65, p 175-187, March 1986. 2 tab, 12 fig, 30 ref.

Descriptors: *Fish, *Metals, *Proteins, *Pollutant identification, *Bioindicators, Cadmium, Zinc, Copper, Crayfish, Hermit crabs, Shrimp, Mussel, Limpets, Bullia, Grass, Heavy metals, Amino acids, Toxicity.

Metal-binding proteins were isolated from different marine animals that were kept under identical enriched conditions. The animals used differed in phyla, size, mass, age, behavior, food, and life stages and included: crayfish, hermit crabs, shrimp, mussels, limpets, bullia, and grass. The metals that were determined were: zinc, cadmium, and copper. The organisms accumulated metals at different rates. Abnormal molting in crustacea was demonstrated in the absence of metal accumulation but in the presence of metal-binding proteins. The presence of metal-binding proteins confirms toxic metal pollution. This concept was then tested under field conditions in the whelk Bullia digitalis and in metal-enriched grass. It is suggested that metal-binding protein determinations should replace metal analyses in pollution studies. (Peters-PTT)
W86-04763

CADMIUM-BINDING PROTEINS IN THE SCALLOP PECTEN MAXIMUS,
Institute of Marine Biochemistry, Aberdeen (Scotland).
H. C. Stone, S. B. Wilson, and J. Overnell.
Environmental Health Perspectives EVHPAZ, Vol. 65, No. 189-191, March 1986. 1 tab, 3 fig, 14 ref.

Descriptors: *Cadmium, *Scallops, *Chromatography, Amino acids, Carbohydrates, Metallothionein, Proteins, Tissue analysis, Detoxification.

Progress in characterizing the cadmium-binding components in the scallop digestive gland is discussed. Scallops accumulate cadmium naturally in the digestive gland to a level of approximately 100 ppm net weight. Of this cadmium, 60% was soluble and was composed of three weight classes as judged by Sephadex G-100 chromatography. Of the soluble cadmium, 60% was in the 55,000 weight range and 20% each in an excluded fraction and a 10,000 molecular weight fraction. The 55,000 molecular weight fraction showed a maximum cadmium concentration of 1.4%. The cadmium was thiolate bound but not as strongly as in the case of metallothionein. The 10,000 molecular weight fraction was a metallothionein-like protein. (Peters-PTT)
W86-04764

ENVIRONMENTAL FATE AND AQUATIC TOXICOLOGY STUDIES ON PHTHALATE ESTERS,
Exxon Chemical Co., Baton Rouge, LA.
E. F. Group, Jr.
Environmental Health Perspectives EVHPAZ, Vol. 65, p 337-340, March 1986. 2 tab, 5 ref.

Descriptors: *Aquatic environment, *Toxicity, *Phthalates, Daphnia, Esters, Trout, Minnows, Algae, Shrimp, Activated sludge, Organic compounds, Biodegradation, Bioassay, Fish, Benthos, Algae, Invertebrates, Solubility.

A condensation of the results and conclusions from Phase 1 of a study sponsored by the Chemical Manufacturers Association (CMA) to broaden the environmental data base on phthalate esters is presented. The concentration at which effects on aquatic life might occur, the potential for bioconcentration in aquatic life, and the relative persistence in the environment of 14 phthalate esters were studied. A total of 195 individual studies were carried out. No single test species was unusually sensitive to the test materials. The higher molecular weight (longer side-chain) phthalates ex-

hibited no toxic effects up to their limits of water solubility in the test systems. No lower molecular weight, more water-soluble phthalates, exhibited unusually severe effects even though they produced toxic effects below their limits of water solubility. Data from water flea chronic studies, coupled with recent data published outside of the CMA program, show that effect levels for di(2-ethylhexyl) phthalate (DEHP) and other phthalates are one to two orders of magnitude (10 x 100 x) above the 3 ppb reproductive effect level for DEHP reported in 1973. Phthalates were shown to be practically nonvolatile and only sparingly soluble in water. The high molecular weight phthalates can be expected to partition preferentially from water to organic matter. All phthalates tested were readily biodegraded under the aerobic/highly microbial population test conditions. The CMA Phthalate Esters Panel believes the scientific data support a conclusion that phthalates do not pose a significant threat to the environment. (Peters-PTT)
W86-04765

FRESHWATER BIOLOGICAL MONITORING.
International Association on Water Pollution Research and Control, London (England).
For primary bibliographic entry see Field 5A.
W86-04767

FRESHWATER BIOLOGICAL MONITORING: KEYNOTE ADDRESS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
For primary bibliographic entry see Field 5A.
W86-04768

EARLY WARNING OF EUTROPHICATION IN RIVERS BY ANALYSIS OF PERIPHYTON CHLOROPHYLL A,
National Board of Waters, Helsinki (Finland). Water Research Inst.
For primary bibliographic entry see Field 5A.
W86-04772

INVESTIGATIONS INTO THE CAUSES OF FISH KILLS OCCURRING IN THE RIVER MEUSE (1979-1983),
Antwerpse Waterwerken (Belgium).
F. Van Hoof, W. Van Craenenbroeck, and D. Marivoet.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. New York, 1984. p 53-63, 5 fig, 6 tab, 10 ref.

Descriptors: *Water pollution, *Cyanide, *Water pollution effects, *Fishkill, Meuse River, River Meuse, Ourthe River, Tissue analysis, Fish kill, Lethal limit, Toxicity, Belgium, Heavy metals, Cadmium, Zinc, Copper.

A series of fish kills occuring in the rivers Meuse and Ourthe at Liege (Belgium) has been investigated by analysis of water samples collected near the sites of the incidents and by analysis of fish tissues obtained from representatives of dominant species killed in the incidents. Most kills were shown to be caused by cyanide containing discharges. In three of these, no other toxicants than cyanide were involved. In the remaining cases discharges containing cyanides and metals were found. The analysis of fish tissues for metals proved to be a valuable tool for confirming or excluding the implication of metals in these incidents. Complementary to the conclusions concerning acute exposure, information is obtained on the levels and distribution of cadmium, zinc and copper due to chronic exposure. For cadmium a substantial decreases in tissue concentrations has occurred over the last five years, which reflected a decrease in cadmium levels in the river Meuse over the same period. No clear trends were observed for tissue levels of copper and zinc although levels of these metals in river water showed a downward trend. (See also W86-04767) (Author's abstract)
W86-04773

ASPECTS OF UTILIZING CONTINUOUS AUTOMATIC FISH BIOMONITORING SYSTEMS FOR INDUSTRIAL EFFLUENT CONTROL,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5A.
W86-04774

TOXICITY TESTING WITH FRESHWATER MACROINVERTEBRATES: METHODS AND APPLICATION IN ENVIRONMENTAL MANAGEMENT,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 5A.
W86-04776

PREDICTION OF THE TOXICITY OF COPPER TO AUSTRALIAN FRESHWATER ANIMALS,
New South Wales Inst. of Tech., Broadway (Australia).
J. F. Skidmore, and I. C. Firth.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. New York, 1984. p 93-101, 3 fig, 7 ref.

Descriptors: *Water pollution effects, *Toxicity, *Prediction, *Bioassay, Prediction, Copper, Zinc, Fish, Invertebrates, Molluscs, Crustaceans, Lethal limit, Australia.

The damaging effects of pollution are usually only evaluated by surveys before and after the pollution has occurred. By then it is often too late to reverse the deterioration to the quality of life. With forethought, toxicity bioassays may be used to predict the adverse effects of potential pollutants before release. By relating pollutants to water quality, and using test animals indigenous to the affected locality, toxicity bioassays can predict quite closely the impact of pollutants on an ecosystem at risk. Work at the New South Wales Institute of Technology has compared the sensitivity of Australian freshwater fish and invertebrates to copper and zinc at three temperatures. Acute tests over 9 days have indicated that freshwater mussels are very resistant to copper, whilst fish and crustaceans are relatively sensitive. Work in progress is attempting to identify the most sensitive life stages of a representative fish, crustacean and snail, in order to assess the maximum acceptable toxic concentration (MATC) of copper to three potential Australian biological indicators of water quality. (See also W86-04767) (Author's abstract)
W86-04777

COMPARISON OF BIOMONITORING TECHNIQUES FOR EVALUATING EFFECTS OF JET FUEL ON BLUEGILL SUNFISH (LEPOMIS MACROCHIRUS),
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
T. R. Doane, J. Cairns, and A. L. Buikema.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. 1984. p 103-112, 2 tab, 25 ref. Grant No. AFOSR-82-0059.

Descriptors: *Hydrocarbons, *Bluegills, *Biological monitoring, *Monitoring, *Water pollution effects, Water pollution, Lepomis macrochirus, Oil pollution, Oil, JP-4, Fish physiology, Sunfish.

The purpose of this study was to compare the effects of the water soluble fraction (WSF) of JP-4, a common military and civilian jet fuel, on survival, behavior, and physiology of bluegill sunfish (Lepomis macrochirus). The dynamic 96-hr LC50 for WSF JP-4 was 26.2% (percent of the maximum soluble amount of JP-4). A 5.1% WSF JP-4 caused a shift in ventilatory rate and amplitude; this concentration was equivalent to the 96-hr LC01. Fish displayed an avoidance reaction when exposed to 3.5 and 4.9% WSF JP-4. At higher concentrations approaching the 96-hr LC50, fish appeared to lose their ability to detect WSF JP-4indicating a potential for fish not to avoid lethal concentrations. Few significant changes in whole and serum blood parameters were detected in fish exposed to 13% WSF JP-4; near the 96-hr LC50 changes were primarily attributed to osmoregulatory failure. (See also W86-04767) (Author's abstract)
W86-04778

LEMNA AS AN INDICATOR OF WATER POLLUTION AND THE ABSORPTION OF HEAVY METALS BY LEMNA,
Shinshu Univ., Matsumoto (Japan). Dept. of Public Health.
For primary bibliographic entry see Field 5A.
W86-04779

APPLICATION OF AN ALGAL ASSAY TO ASSESS TOXICITY AND EUTROPHICATION IN POLLUTED STREAMS,
Norsk Inst. for Vannforskning, Oslo.
T. Kallqvist.
IN: Freshwater Biological Monitoring, Proceedings of a Specialised Conference held in Cardiff, England, September 12-14, 1984. 1984. p 121-129, 2 fig, 3 tab, 7 ref.

Descriptors: *Bioassays, *Toxicity, *Eutrophication, *Water pollution effects, *Algal growth, Water pollution, Monitoring, Biological monitoring, Running waters, Lotic environment, Selenastrum capricornutum, Oslo, Norway. Domestic wastes.

Algal assays can give information on the content of nutrients as well as toxic compounds in water samples. These characteristics of the algal assays were utilized in a study of four streams running through the city of Oslo. The streams receive pollutants from municipal sewage, industrial wastewater and surface runoff. The pollution situation is therefore often very complicated. Water samples from different parts of the streams were divided into two fractions. To one of these a nutrient solution was added. Algal assays with the green alga Selenastrum capricornutum were performed on both fractions. From the cell yield, growth rate and shape of the growth curves it was possible to classify the water samples into five categories as regards nutrient content and toxic properties. The algal assays revealed that the water quality of the streams changed drastically on the way through the city. Pollution caused by seepage of domestic sewage from the sewerage system resulted in very high algal growth potential in streams running through built up areas. Toxic effects of industrial wastewaters were also detected. The study has shown that algal assays may be a useful supplement to chemical analysis to assess the state of pollution. The bioassays provide a simple and effective instrument for the identification of sources of toxic pollutants and nutrients causing eutrophication. (See also W86-04767) (Author's abstract)
W86-04780

COMPLIANCE BIOMONITORING - STANDARD DEVELOPMENT AND REGULATION ENFORCEMENT USING BIOMONITORING DATA,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W86-04783

BIOACCUMULATION AND EFFECTS ON REPRODUCTION IN AQUATIC ORGANISMS: AN ASSESSMENT OF THE CURRENT LITERATURE,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5B.
W86-04825

HYDROTHERMAL-BIOLOGICAL COUPLING OF LAKE EUTROPHICATION MODELS,
Massachusetts Inst. of Tech., Cambridge. Ralph M. Parsons Lab. for Water Resources and Hydrodynamics.
M. -P. Wang, and D. R. F. Harleman.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB83-174391,

Price codes: A17 in paper, A01 in microfiche. Report No. 270, April 1982. 384 p, 192 ref, 2 append. Contract No. CEE7906125.

Descriptors: *Eutrophication, *Limnology, *Model studies, *Lakes, *Hydrothermal-Biological model, Phytoplankton, Nutrients, Phosphorus, Dynamics, Hydrologic data collection.

A deterministic model is developed to simulate lake response to changes in hydrologic conditions or nutrient input. The state of the art of hydrothermal modeling in a phosphorus-limited condition is presented. It is demonstrated that a mixed layer hydrothermal model, which calculates the daily vertical temperature profile and thickness of the upper fully mixed layer based on meteorological and hydrological information, is capable of simulating the transport and diffusive process in a stratified lake with a minimum number of calibrated parameters. Phytoplankton modeling of L227 is used as a case study to illustrate the methodology for arriving at a biological model whose complexity is consistent with available data. A procedure is indicated for extracting biological rate constants from primary productivity measurement, and the extent to which the linked hydrothermal-biological model simulates the phytoplankton dynamics is discussed. The importance of capturing the short-term dynamics of the fully mixed layer in the modeling of phytoplankton variation is illustrated. (Author's abstract)
W86-04938

HEALTH HAZARDS ASSOCIATED WITH WINDSURFING ON POLLUTED WATER,
Laval Univ., Quebec. Dept. of Medicine.
E. Dewailly, C. Poirier, and F. M. Meyer.
American Journal of Public Health, Vol. 76, No. 6, p 690-691, June 1986. 2 tab, 13 ref.

Descriptors: *Water pollution effects, *Swimming, *Rivers, Canada, Quebec, St. Lawrence River, Gastroenteritis, Otitis, Conjunctivitis, Skin infection, Human diseases, Recreation, Windsurfing.

In August 1984, the Windsurfer Western Hemisphere Championship was held in Quebec city, on the St. Lawrence River in the baie de Beauport, where water is contaminated by sewage. This event prompted an assessment of the health hazards associated with windsurfing on polluted water. There were 79 windsurfers and 41 controls who were studied over a nine-day period for occurrence of symptoms of gastroenteritis, otitis, conjunctivitis, and skin infection. Relative risks were 2.9 for occurrence of one or more of these symptoms and 5.5 for symptoms of gastroenteritis. Relative risk increased with the reported number of falls into the water. (Peters-PTT)
W86-04943

INFECTIOUS DISEASES AND FIELD WATER SUPPLY AND SANITATION AMONG MIGRANT FARM WORKERS,
Utah Univ., Salt Lake City. Coll. of Health, Physical Education, and Recreation.
D. M. Arbab, and B. L. Weidner.
American Journal of Public Health, Vol. 76, No. 6, p 694-695, June 1986. 1 tab, 2 ref.

Descriptors: *Sanitation, *Fecal-related disease, *Water supply, Migrant workers, Water supply, Legal aspects, Feces, Public health, Human diseases, Standards, Regulations.

The Occupational Safety and Health Administration (OSHA) requested testimony regarding fecal-related diseases among migrant farm workers in Utah, where there is no law for provision of excreta disposal, hand washing, and drinking water facilities for farm workers. An audit was performed on clinic charts for 936 migrant workers and 8,968 urban poor. Migrants displayed a clinic utilization rate for diarrhea 20 times higher than that of the urban poor. Similar findings for other enteric disease symptoms were documented. The data suggest that a water and sanitation standard mandating facilities in the work field for farm workers would reduce the incidence of fecal-related disease. (Peters-PTT)
W86-04944

CHRONIC TOXICITY OF 4-NITROPHENOL TO DAPHNIA MAGNA STRAUS UNDER STATIC-RENEWAL AND FLOW-THROUGH CONDITIONS,
Lilly (Eli) and Co., Indianapolis, IN. Lilly Research Lab.
P. C. Francis, D. W. Grothe, and J. C. Scheuning.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 36, No. 5, p 730-737, May 1986. 3 tab, 1 fig, 11 ref.

Descriptors: *Daphnia, *Toxicity, *Pesticides, *Bioindicators, Nitrophenol, Survival, Neonates, Population dynamics, Growth rates, Testing procedures.

The objectives of the study were to develop a flow-through system for chronic testing with Daphnia magna; compare the reproduction and growth of D. magna under flow-through and static-renewal conditions; and evaluate the chronic toxicity of 4-nitrophenol (4-NP) in the two test systems. Survival frequencies in the static-renewal test ranged from 70% at 20 mg/liter to 100% in the control. At 4-NP concentrations < or = 50 mg/liter, average neonate production per female ranged from 111.7 to 124.6. Significant decreases in reproduction per female dropped to 88.4 and 11. The only significant reduction in growth occurred at 20 mg/liter where body lengths averaged 3.87 mm compared to mean lengths of 4.19 to 4.27 mm at concentrations < or = 10 mg/liter. Under flow-through conditions, survival frequencies at 4-NP concentrations of < or = 10 mg/liter ranged from 65% to 90% compared to control survival of 90%. Total mortality occurred at the 20 mg/liter treatment by day 7. As in the static-renewal test, 10 mg/liter was the lowest concentration that caused a significant decrease in reproduction. It is concluded that 4-NP concentrations > or = 10 mg/liter were chronically toxic to D. magna under both static-renewal and flow-through conditions. (Peters-PTT)
W86-04962

IMPACT OF PULP AND PAPER MILL EFFLUENT ON EGG HATCHABILITY OF PIKE (ESOX LUCIUS L.),
Finnish Pulp and Paper Research Inst., Helsinki.
J. Tana, and E. Nikunen.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 36, No. 5, p 738-743, May 1986.

Descriptors: *Pulp and paper industry, *Pike, *Effluent, *Fish eggs, *Hatching, Finland, Wastewater disposal, Mortality, Survival, Bioassay, Teratogenicity, Kraft mill wastes.

The egg survival and malformation frequencies of a pike population living in a pulp and paper discharge area were studied and compared with corresponding values of a reference group from a clean area. The effects of different pulp and paper mill effluent concentrations on survival and malformation frequencies were examined and the impact of waste water concentration at the fertilization moment was studied. The eggs of pikes caught from the discharge site of the mill were more resistant to the effluent than the eggs of fish from a clean area; a higher percentage of eggs stayed alive in all the effluent concentrations used. All the waste water concentrations used (0.5, 2.5, and 10% bleached kraft pulp mill effluent) caused significant increases in egg mortality. The highest concentrations used raised the mortality quickly whereas the eggs died later in a more dilute solution. A significant positive linear correlation was obtained between the effluent concentration and mortality. No significant alterations in malformation frequencies could be detected. The pike population that lived in the recipient site showed indices of acclimatization to the strongly altered water quality. Hauling increased the mortality of the eggs of the exposed pike population. The intolerance to hauling may indicate that the acclimatization to pulp and paper wastewater diminished the capacity to survive in simultaneous stress. (Peters-PTT)
W86-04963

EFFECTS OF TEMPERATURE ON THE ACUTE TOXICITY OF PCP IN THE MIDGE CHIRONOMUS RIPARIUS MEIGEN,
Ohio State Univ., Columbus. Dept. of Entomology.
S. W. Fisher.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 36, No. 5, p 744-748, May 1986. 2 tab, 1 fig, 14 ref.

Descriptors: *Toxicity, *Midges, *Organic pesticides, *Temperature effects, Phenols, Aquatic animals, Pentachlorophenol, Bioassay, Herbicide.

The results of studies conducted on the acute toxicity of the pesticide pentachlorophenol (PCP) under different temperature regimes in the aquatic invertebrate, Chironomus riparius are presented. The toxicity of PCP varies significantly with temperature. The compound is most toxic at 35 C and least toxic at 25 C. PCP is of intermediate toxicity at 15 C. The initial rate of uptake of 14C-PCP is rapid for all three temperatures. An apparent maximum is reached at 21 hours following which depuration of the chemical appears to exceed absorption. The 24 hr uptake readings are slightly depressed relative to the respective 21 hr measurements. The internal concentrations of 14C-PCP at 24 hr decrease in the order 35 > 15 > 25 which is consistent with the toxicity data. Significantly higher levels of PCP are present in the midges held at 35 C than in those maintained at 25 C. Temperature is clearly a factor which must be taken into account when assessing the hazard of aquatic pollutants. (Peters-PTT)
W86-04964

ACCUMULATION AND METABOLIC EFFECTS OF DI-N-BUTYLTIN DICHLORIDE IN THE FRESHWATER CLAM, ANODONTA ANATINA,
Utrecht Rijksuniversiteit (Netherlands). Lab. of Chemical Animal Physiology.
D. A. Holwerda, and H. J. Herwig.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 36, No. 5, P 756-762, May 1986. 4 tab, 2 fig, 18 ref.

Descriptors: *Clams, *Toxicity, *Metals, Metabolism, Body burden, Cadmium, Tin, Kidneys, Pollutants, Animal physiology.

The metabolism of clams exposed to dialkytin compounds was examined. The accumulation and location of tin in several organs were determined. Anodonta anatina L. were collected from a pond near Leiden and were exposed to 0.125 millimoles dibutyltin dichloride (DBTC) (equivalent to 15 ppb Sn) for 7 mo. DBTC was not lethal to the clams at this concentration. DBTC significantly influenced parameters that are indicative of delivery and status of energy. The dry weight decreased from 6.8% to 3.8%. Carbohydrate stores were reduced to <25%. The data indicate that the intoxicated clams relied on an anaerobic type of energy metabolism; in all tissues containing significant amounts of glycogen in control animals, glycogen was markedly reduced after exposure of the clams to DBTC. The highest concentrations of tin were found in the kidney. Simultaneous exposure of Anodonta to cadmium chloride did not result in cadmium storing in the kidney. The kidneys did not contain >6% of the total Cd body burden. (Peters-PTT)
W86-04965

TRACE METALS IN MUSSELS (MYTILUS EDULIS) FROM THE WADDENZEE, COASTAL NORTH SEA AND THE ESTUARIES OF EMS, WESTERN AND EASTERN SCHELDT,
Fish Technology Inst. TNO, Ijmuiden (Netherlands).
J. B. Luten, W. Bouquet, M. M. Burggraaf, A. B. Rauchbaar, and J. Rus.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 36, No. 5, p 770-777, May 1986. 6 tab, 1 fig, 5 ref.

Descriptors: *Trace metals, *Mussels, *Estuaries, The Netherlands, Mercury, Cadmium, Lead, Zinc, Copper.

The trace metal content of mussels in the Netherlands has been monitored as part of the Joint Monitoring program for the assessment of the level of marine pollution and the effectiveness of measures taken for its reduction. About 25% of all examined mussel samples have a mercury content >0.5 mg/kg dry matter. The highest mercury content was observed in the Ems-Dollard estuary. The lowest mercury content was found in a sample from the Western Scheldt. The lead contents in mussels from Ems-Dollard, Eastern Scheldt and Waddenzee did not significantly differ from each other. The median lead content in mussels from the coastal North Sea (Noordwijk) was somewhat higher (4.3 mg/kg dry matter). The median lead content of mussels from the Western Scheldt varied from 5.6 to 6.7 mg/kg dry matter. The highest lead content (12.9 mg/kg dry matter) was found in a mussel sample from the Western Scheldt. The lowest lead content (1.4 mg/kg) was in a sample from the Eastern Scheldt. The accumulation of cadmium in mussels from the Western Scheldt sampling locations was much higher than in mussels from the other sampling locations. In the Western Scheldt estuary the cadmium results show a downward gradient from Zuidergat towards the open sea. The highest copper content (29.0 mg/kg) was found in mussels from the Western Scheldt. The median zinc content of mussels from the Waddenzee (87 mg/kg dry matter) was two to three times lower than the median zinc content in mussels from the Western Scheldt and Zuidergat. It is concluded that the trace metal content in mussels from the Western Scheldt is higher than the content of trace metals in mussels from the other sampling locations. (Peters-PTT)
W86-04967

CAUSTIC WASTE MENACES JAMAICA,
J. Bell.
New Scientist, Vol. 110, No. 1502, p 33-37, April 3, 1986.

Descriptors: *Caustic wastes, *Iron oxides, *Jamaica, *Groundwater pollution, Bauxite, Alumina, Industrial wastes, Sodium hydroxide, Wells, Slurries, Aquifers, Alkalinity, Phytotoxicity, Springs.

Each year, bauxite processing in Jamaica produces enough caustic mud to bury 700 football fields and their goalposts. The search is on for ways to limit the waste and its hazards. Bauxite treated with sodium hydroxide (caustic soda) produces aluminium oxide (alumina) and solid waste in about equal quantities. Jamaica's exports of alumina help to feed the world's demand for aluminium. The waste that remains, called red mud, presents a problem. Its particles, mainly of iron oxide, are tiny. More than half are <0.5 micrometers. The result is a slurry that the industry dumps in ponds in dammed valleys, old bauxite pits and clay-lined ponds. The highly caustic red mud waste, which is dangerous to people, plants, and animals has leaked or seeped from two of the biggest ponds and contaminated some shallow wells and ground water. One spring, which rises from an aquifer, is almost as alkaline as the red mud itself, although the aquifers show no sign of alkaline pollution so far. If it is allowed to dry, the slurry becomes hardest at the surface and much softer underneath. Although the Alpart Company has ceased alumina production, its red mud pond remains. The concentration of sodium (which kills plants) in wells near Alpart rose from the year that production began. Seeping ponds have polluted ground water. The worry is that streams and aquifers might become affected. The only way to reclaim a pond is to cover it with topsoil. (Peters-PTT)
W86-04970

EFFECT OF FLUORIDES ON SURVIVAL AND REPRODUCTION OF DAPHNIA MAGNA,
Pittsburgh Univ., PA. Dept. of Industrial Environmental Health Sciences.
A. H. Fieser, J. L. Sykora, M. S. Kostalos, Y. C. Wu, and D. W. Weyel.
Journal of the Water Pollution Control Federation, Vol. 58, No. 1, p 82-86, January 1986. 3 fig, 5 tab, 12 ref.

Descriptors: *Water pollution effects, *Daphnia magna, *Fluorides, *Survival, *Reproduction, *Bioassay, *Toxicity, Mathematical models, Temperature, Hard water, Egg production, Hatchability, Baseline studies.

Baseline data were obtained for the effects of dissolved fluoride on Daphnia magna survival and reproduction. The model developed in this study shows that there exists a simple exponential relationship between the toxicity of fluorides and temperature in hard water. Chronic testing of D magna in hard water at 20 C indicated that the presence of F- anions has a multiple effect on the reproductive system. Increases in F- content up to 65 mg/L F- stimulate egg production by increasing amounts, up to 150% of the control. Conversely, increasing F- concentrations reduce the hatchability rate continuously with a sharp decrease around 34 mg/L. Neonate production equivalent to that of controls was established at 29 mg/L F-, which is, in effect, a 'break-even' point between increased egg production and reduced hatchability. The chronic-to-acute ratio calculated from this safe concentration and the corresponding acute value for hard water was 20 C at 0.12. The application factor calculated on the basis of maximum acceptable toxicant concentration was established to be between 0.11 and 0.14. (Rochester-PTT)
W86-05024

DECLINING LAKE SEDIMENT PHOSPHORUS RELEASE AND OXYGEN DEFICIT FOLLOWING WASTEWATER DIVERSION,
Washington Univ., Seattle. Dept. of Civil Engineering.
E. B. Welch, D. E. Spyridakis, J. I. Shuster, and R. R. Horner.
Journal of the Water Pollution Control Federation, Vol. 58, No. 1, p 92-96, January 1986. 3 fig, 2 tab, 16 ref.

Descriptors: *Water pollution effects, *Lake Sammamish, *Phosphorus, *Lake sediments, *Oxygen deficit, *Wastewater diversion, *Hypolimnion, Mass balance model, Washington, Chlorophyll A, Cores, Oxygen demand, Flocculation, Particulate matter, Sediments.

Sediment phosphorus release rates were determined in vitro from cores obtained in Lake Sammamish, Washington, and these data and sediment P content results were compared with results from the early 1970s. In addition, a P mass balance model was used to independently evaluate sediment release. Lake Sammamish failed to show a predictable response after P loading was reduced by one-third through wastewater diversion in 1968. Over the past 5 yr, however, P concentrations, summer chlorophyll a, and transparency have improved markedly. This dramatic improvement has been largely the result of a decrease in the anaerobic sediment P release rate during summer and fall. The decrease in sediment P release, as determined recently by the rate of hypolimnetic buildup of P, was substantiated by sediment content of interstitial P and by rate of P release in anaerobic columns, but not by total P content in the sediment. Decreased P release rate was also verified by mass balance model. The observed trend of a decreasing rate of hypolimnetic P buildup following diversion may have been caused by a gradual removal of flocculent particulate material, and hence the decreased oxygen demand, at rates much less than the flushing rate. (Rochester-PTT)
W86-05025

OZONIZATION OF HUMIC ACIDS. MEDIUM TERM TOXICITY TOWARDS DAPHNIA MAGNA,
Lille-2 Univ. (France). Unit of Pharmacy.
M. Imbenotte, J. Pommery, N. Pommery, and F. Erb.
Ozone, Vol. 8, No. 1, p 37-48, 1986. 4 tab, 3 fig, 8 ref.

Descriptors: *Ozonation, *Daphnia, *Humic acids, Toxicity, Trace metals, Lyophilization, Surface waters.

The determination of the possible toxicity of ozonized humic acids is investigated. The ozonation products of humic acids are toxicologically interesting because of both their actual toxicity and also, because of their complexing vis-a-vis trace metals present in water. These trace metals are not completely eliminated by potabilization techniques. Determination of the ultimate toxicity of ozonized humic acids is achieved with the aid of the medium term Daphnia magna test. Statistical treatment of the two lethal parameters and of the four sublethal parameters have shown a toxicity for ozonized humic acids in solution, at a concentration of 100 mg/liter. Ultrafiltration allowed isolation of those fractions discovered to be responsible for complexing of metals (M>3 times 100,000 and M <5 times 1000). In following the change of chemical structure of the compounds under the effect of ozonation, it is clear that the medium term toxicity can be related to the increase in aromatic character, which is practically triple in the intermediate mass fraction. The first fraction is toxic only after ozonation, and uniquely on a level of a number of ranges. The fraction M<5 times 1000 before ozonation manifests an appreciable sublethal toxicity on N sub p from a concentration of 2.04 mg/liter. This toxicity disappears after ozonation. Ozonation causes a lethal toxicity of this fraction shown by the CEI 50 (8.9 mg/liter). This concentration is very near to those usually encountered in surface waters. (Peters-PTT)
W86-05041

EFFECTS OF SYNTHETIC POLYELECTROLYTES ON SELECTED AQUATIC ORGANISMS,
Environmental Research Lab.-Duluth, MN.
K. E. Biesinger, and G. N. Stokes.
Journal of the Water Pollution Control Federation JWPFA, Vol. 58, No. 3, p 207-213, March 1986. 7 fig, 5 tab, 12 ref.

Descriptors: *Polyelectrolytes, *Toxicity, *Aquatic organisms, Acute toxicity, Daphnids, Fathead minnows, Gammarids, Midges, Detoxification, Aquatic animals, Algae, Flocculation, Clays.

A series of experiments was conducted on the toxicity of synthetic polyelectrolytes, used extensively in potable and wastewater treatment to promote flocculation. Acute toxicities were tested on daphnids, fathead minnows, gammarids, and midges. Nonionic and anionic polymers were not acutely toxic; cationic polymers were very toxic, their toxicity varying widely with their chemical structure. A subsequent microcosm test using five aquatic animals and 10 algal species showed varying effects on species densities and compositions. Additional studies demonstrated the detoxification of cationic polyelectrolytes by anionic polyelectrolytes and by red, montmorillonite, and kaolinite clays. Finally, gill damage as a result of cationic polyelectrolyte exposure was described based on microscopic examination of fathead minnow gill tissue. (Doria-PTT)
W86-05050

EFFECTS OF ACID EXPOSURE ON THE ION REGULATION AND SEAWATER ADAPTATION OF COHO SALMON (ONCORHYNCHUS KISUTCH) PARRS AND SMOLTS,
Simon Fraser Univ., Burnaby (British Columbia). Dept. of Biological Sciences.
J. F. F. Powell, and B. A. McKeown.
Comparative Biochemistry and Physiology, Vol. 83C, No. 1, p 45-52, 1986. 6 fig, 38 ref.

Descriptors: *Water pollution effects, *Physiological ecology, *Coho salmon, *Acid streams, Fish, Fish physiology, Aquatic environment, Sodium, Enzymes, Potassium.

Juvenile coho salmon parrs and smolts were subjected to acid stress in soft water prior to entry into seawater in order to determine possible lifestage-dependent deleterious effects of acid exposure. Parrs and smolts of one year-class were exposed to acid for varying times; parameters to assess ion regulatory ability were measured in these fish while in freshwater as well as fish exposed to seawater. Smolts exhibited decreases in

plasma sodium levels after 7 days and lower Na(+), K(+)-ATPase activities 14 days after acid exposure. Parrs exhibited increased plasma Na(+) as well as Na(+), K(+)-ATPase activity immediately after transfer to seawater. It is concluded that acid exposure prior to entry into seawater is detrimental to coho salmon with regard to the length of acid exposure and state of development. It is suggested that a possible method by which fish die from acid stress is inhibition of gill Na(+), K(+)-ATPase concomitant with decreases in plasma Na(+) levels. (Doria-PTT)
W86-05061

SEROTYPES OF VIBRIO PARAHAEMOLYTICUS ISOLATES FROM HYDROBIOLOGICALLY DISSIMILAR AQUATIC ENVIRONMENTS,
National Inst. of Cholera and Enteric Diseases, Calcutta (India).
For primary bibliographic entry see Field 5A.
W86-05062

STUDIES OF DIURNAL ACID FLUCTUATIONS IN BRITISH ISOETID-TYPE SUBMERGED AQUATIC MACROPHYTES,
Saint Andrews Univ. (Scotland). Dept. of Plant Biology and Ecology.
A. M. Farmer, and D. H. N. Spence.
Annals of Botany ANBOA4, Vol. 56, No. 3, p 347-350, September 1985. 3 tab, 16 ref.

Descriptors: *Plant physiology, *Isoetids, *Crassulacean acid metabolism, *Macrophytes, Submerged plants, Aquatic plants, Oligotrophic lakes, Lakes, Photosynthesis, Diurnal distribution.

British isoetid species were surveyed for Crassulacean acid metabolism (CAM) in plants collected directly from a small lake and in plants grown under constant conditions in the laboratory. Wide diurnal fluctuations in titratable acidity (to pH 6.4) were found in Isoetes lacustris and in both terrestrial and submerged populations of Littorella uniflora. They were absent in Lobelia dortmanna, Subularia aquatica, Eriocaulon septangulare, Ranunculus flammula, and Pilularia globulifera. It is hypothesized that CAM is selected in Isoetes spp. as a means of enhancing carbon gain in carbon-limiting environments. Isoetids also possess two additional mechanisms to increase carbon fixation. Root uptake of carbon dioxide is an adaptation to oligotrophic lakes where the sedimentary interstitial water is much richer in dissolved inorganic carbon than the lake water. Also, large lacunae and thick cuticles are efficient at trapping CO2 generated by photorespiration. These mechanisms conserve carbon or trap richer carbon sources, and would enable the plant to avoid competition with other macrophytes which absorb CO2 from lake water. Only one species, Littorella uniflora, is known to possess all three mechanisms; it is also the most widely distributed isoetid, existing over a broad range of alkalinities and trophic levels. (Doria-PTT)
W86-05064

EFFECTS OF CHLORINE AND AMMONIA FROM WASTEWATER TREATMENT FACILITIES ON BIOTIC INTEGRITY,
Illinois Univ. at Urbana-Champaign. Dept. of Ecology, Ethology and Evolution.
J. R. Karr, R. C. Heidinger, and E. H. Helmer.
Journal of the Water Pollution Control Federation JWPFA, Vol. 57, No. 9, p 912-915, September 1985. 2 fig, 1 tab, 12 ref. Illinois Department of Energy and Natural Resources Project No. 20.132; EPA Grants R-806391 and CR-810745.

Descriptors: *Wastewater treatment, *Water pollution effects, *Biotic integrity, *Chlorine, *Ammonia, Halogens, Cost-benefit analysis.

Construction projects for wastewater treatment have the goal of improving both chemical and biological integrity. Wasteload allocation models used to site and design treatment facilities usually emphasize reduction in chemical loading to the receiving system and assume that biological integrity will improve. Chorination kills pathogens discharged in wastewater effluents but the residual chlorine can produce toxic effects in fish and other biota. Ammonia at high concentrations is also detrimental to aquatic life. The purpose of this study was to determine if IBI (Index of Biotic Integrity) is sensitive enough to track changes in the biota of streams that are subjected to various concentrations of chlorine and ammonia. IBI varied in space and in time in concert with known variation in physical, chemical, and biological parameters in the stream. IBI clearly showed that inclusion of chlorine in secondary wastewater treatment has major negative impacts on biotic integrity. IBI also showed that massive expenditures required for removal of ammonia in tertiary treatment plants are not always warranted. In many cases, nitrogen levels do not limit biotic integrity. (Khumbatta - PTT)
W86-05067

WATER AND NEPAL,
C. Collins.
Journal of the Royal Society of Health, Vol. 105, No. 5, p 181-183, October 1985. 4 ref.

Descriptors: *Nepal, *Water-borne disease, Contamination of water supply, Water quality management.

The lack of available safe drinking water and sanitation is a serious problem throughout the country of Nepal. The demand for water is ever increasing especially in the hills and mountains. More concentrated water supply programmes will have far reaching impact on the well being of the people in the rural areas. The lack of safe drinking water has a deleterious impact on the life in Nepal and water-borne diseases are common throughout the country. Both streams and groundwater supplies are unreliable and not safe to drink. In Katmandu, water leaves the treatment plant free of pathogens but becomes contaminated in the distribution system. Most of this problem is caused by the intermittent water supply which leaves the pipes empty for part of the day. If Nepal can develop water as it intends to, development will occur in all other fields as well, and this will help to control the water-borne diseases which are so prevalent and improve the general health status of the country. (Khumbatta-PTT)
W86-05075

STUDIES ON THE ACUTE TOXICITY OF POLLUTANTS TO FRESHWATER MACROINVERTEBRATES: 3. AMMONIA,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
K. A. Williams, D. W. J. Green, and D. Pascoe.
Archiv fuer Hydrobiologie AHYBAY, Vol. 106, No. 1, p 61-70, 1986. 2 fig, 4 tab, 14 ref. EEC Contract ENV.484.81 UK(H).

Descriptors: *Water pollution effects, *Macroinvertebrates, *Ammonia, *Toxicity, Lethal limit, Median tolerance limit, Mollusks, Insects, Crustaceans, Oligochaetes, Ecological effects.

Acute toxicity tests (approximately 14 days) using a continuous-flow testing apparatus were conducted on eleven species of macroinvertebrate. In assessing the acute toxicity of this pollutant the relative importance of the ammonium ion (NH4(+)) and the unionized molecule (NH3) was determined. The median lethal time (LT50) for each species decreased with increasing ammonia concentration (total and unionized). Results showed that the ionized form of ammonia (NH4(+)) was not acutely toxic, the concentration of the unionized molecule (NH3) determining the acute toxicity of ammonia. Interspecific differences in 96 h LC50 values were observed with a fourfold difference between the most sensitive (P. tennuis) and the most tolerant species (H. angustipennis). The mollusk L. stagnalis was approximately twice as sensitive as another mollusk P. fontinalis. The insects L. ineris, C. riparius, B. rhodani and E. ignita were all intermediate in sensitivity while the oligochaete L. hoffmeisteri and the crustaceans G. pulex and A. aquaticus proved most resistant of the species tested. The species studied were of similar sensitivity when assessed after 150 hours exposure. However, sensitivities were very different with respect to toxic threshold concentrations over very short exposure periods. Thus some macroinvertebrates in the present study would survive for short periods in high concentrations, which would be lethal to other species. (Lantz-PTT)
W86-05086

BENTHIC MACROINVERTEBRATE COMMUNITY STRUCTURAL AND FUNCTIONAL GROUP RESPONSE TO THERMAL ENHANCEMENT IN THE SAVANNAH RIVER AND A COASTAL PLAIN TRIBUTARY,
Indiana Univ. at Bloomington. School of Public and Environmental Affairs.
N. L. Poff, and R. A. Matthews.
Archiv fuer Hydrobiologie AHYBAY, Vol. 106, No. 1, p 119-137, 1986. 3 fig, 3 tab, 51 ref. DOE Contract DE-AC0976SR00001.

Descriptors: *Macroinvertebrates, *Thermal pollution, *Savannah River, *Coastal plains, Benthic fauna, Water pollution effects, Thermal stratification, Thermal water, Thermal stress, Effluents, South Carolina, Powerplants.

Benthic macroinvertebrate community structure and functional groups on leaf detritus in a thermal, post-thermal and an undisturbed stream, and in the Savannah River immediately downstream from each stream mouth, were compared over a 7 week (48 d) period from December 1982 to February 1983. Temperatures in the post-thermal and undisturbed streams ranged from 4-8 and 4-11 C, respectively, and from 7-12 C in the Savannah River. Temperatures in the thermal stream fluctuated irregularly between 7-31 C and in the river below this stream mouth between 7-22 C. A total of 13,993 macroinvertebrates representing at least 51 families and 84 genera are collected. Numbers of organisms and taxa were depressed at the thermal stream site, whereas numbers of both organisms and taxa were depressed at the thermal stream site, whereas numbers of both organisms and taxa increased at the river site receiving thermal effluent. Chironomids of the subfamily Orthocladiinae comprised 46-60% of the fauna at all sites except in the thermal stream, where they comprised 5%. Gastropoda, Tanypodinae, and Chironominae, each contributed over 20% to the fauna at the thermal stream. Trichoptera represented 12-13% of the riverine fauna at the ambient sites, but 25% at the thermally-perturbed site. Collectors (mostly gatherers) contributed 51-75% at all sites except the thermal stream, where scrapers dominated with 39%. Filterer relative abundance increased from 16-19% at the ambient river sites to 29% at the thermally-perturbed river site, suggesting that suspended carbon transport from the thermal stream occurred and subsidized the macroinvertebrate community in the Savannah River. (Lantz-PTT)
W86-05089

EFFECT OF RIVER WATER ON PHYTOTOXICITY OF BA, CD AND CR,
Illinois State Water Survey, Peoria. Water Quality Section.
W. Wang.
Environmental Pollution (Series B), Vol. 11, No. 3, p 193-2004, 1986. 10 fig, 10 ref.

Descriptors: *Phytotoxicity, *Water pollution effects, *Duckweed, *Barium, *Cadmium, *Chromium, Illinois River, Deionized water, Toxicity, Heavy metals, Chemical reactions, Biological properties.

The phytotoxicity of heavy metals in the environments of deionized water and Illinois River water was compared. An attempt was made to differentiate which fraction of the river water (dissolved vs. particulate) was affecting the phytotoxicity. A 75 liter sample of Illinois River water was taken on December 6, 1982 for comparison with deionized water to test metal toxicity to duckweed. Barium, cadmium and chromium (VI) were tested. There were three different types of results. Ba is moderately toxic in deionized water and non-toxic in river water. Cd is extremely toxic in deionized water and also substantially toxic, though somewhat less so, in river water. Cr(VI) toxicity in river water is more or less identical to that in

deionized water. The results suggest that biological effects and chemical characteristics are interrelated. There are substantial differences between the results of using deionized water and ambient water samples, and more importantly, the differences are dependent upon species of metal ions. (Peters-PTT)
W86-05101

IMPACT OF PHYSIO-CHEMICAL STRESS ON THE TOXIGENICITY OF VIBRIO CHOLERAE,
London School of Hygiene and Tropical Medicine (England). Dept. of Tropical Hygiene.
For primary bibliographic entry see Field 5B.
W86-05105

HEALTH EFFECTS AND RISKS FROM RN222 IN DRINKING WATER,
Battelle Pacific Northwest Labs., Richland, WA. Biology Dept.
F. T. Cross, N. H. Harley, and W. Hofmann.
Health Physics, Vol. 48, No. 5, p 649-670, May 1985. 6 tab, 122 ref. Dept. of Energy contract DE-ACO6-76RLO 1830.

Descriptors: *Water pollution effects, *Public health, *Drinking water, *Radon radioisotopes, *Air pollution, Uranium radioisotopes, Mine wastes, Radioactive wastes, Carcinogens, Epidemiology.

This paper presents an evaluation of the inhalation and digestion doses from exposure to Rn and Rn progeny and gives an overview of the human and animal health-effects data. Estimates of the lung cancer risks and stomach and whole-body cancer risks from exposure to Rn and Rn-progeny in drinking water are also examined. A rounded Rn-in-water concentration limit of 10,000 pCi/L can be supported by health-effects considerations alone, based on the conservative 'tolerance dose' concept and other conservative assumptions regarding lung dose. A practical concentration limit (or action level) of 20,000 pCi/L has been derived by estimations of exposure distributions in the United States and in relation to current U. S. Environmental Protection Agency standards for U-tailings-contaminated buildings. It is suggested that before a maximum contaminant level for Rn in water can be firmly established, the broader issue of setting the maximum contaminant level for Rn in indoor air must be addressed. (Geiger-PTT)
W86-05143

EUTROPHICATION IN NORTHERN TUNISIA,
Deutsche Gesellschaft fuer Technische Zusammenarbeit G.m.b.H., Eschborn (Germany, F.R.).
P. Krause, and H. Krist.
Aqua AQUAAA, No. 2, p 98-102, 1986. 4 fig, 4 ref.

Descriptors: *Water pollution effects, *Eutrophication, *Tunisia, *Lakes, Reservoirs, Sidi Salem, Legal aspects, Effluents, Wastewater treatment, Water quality control, Rain, Water quality control, Recreation, Long-term planning, Water quality management.

This paper examines two cases of overloading of waters with nutrients as a result of human activities, which have occurred in North Africa, showing the specific problems encountered and the measures taken to overcome them. Under the German-Tunisian cooperation program, two different bodies of water showing evidence of eutrophication, the Sidi Salem reservoir and the Lagoon of Tunis. The Sidi Salem reservoir, 2 years after its first filling, is already in a mesotrophic to mildly eutrophic state. Effluent treatment must be taken into the Beja area to prevent total eutrophication of the lake. The Lagoon of Tunis is undergoing complete rehabilitation by protecting the lagoon from treated effluents and mixed rainwater/effluent, by means of open ring drains. The cost of this procedure, and its prospects for future use as a recreational area, are discussed. (Lantz-PTT)
W86-05150

MARINE BENTHOS IN RELATION TO PORE WATER CHEMISTRY AND SEDIMENT GEOCHEMISTRY OF SIMULATED DREDGED MATERIAL,
Delaware Univ., Lewes. Coll. of Marine Studies.
D. Maurer, T. M. Church, C. Lord, and C. Wethe.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 3, p 369-377, 1985. 2 tab, 29 ref.

Descriptors: *Benthos, *Sediments, *Dredging, *Spoil banks, Interstitial water, Geochemistry, Oxygen, Ammonia, Silt, Clay, Sulfide, Hydrogen ion concentration.

Studies on changes in pore water chemistry and sediment geochemistry in simulated dredged material revealed the presence of patterns. There was a marked decrease in mean oxygen concentration between overlying water and pore water and a marked increase in mean ammonia concentration. Ammonia concentration in sediments with silt-clay was several times higher than values for 100 percent sand. No sulfide was recorded by Day 1 for all sediment types. Sulfide increased regularly with depth in 100% sand by Day 8 and Day 15 but no regular trends with depth were observed in sediments with silt-clay. Hydrogen ion concentration values were relatively stable with depth, sediment type, and time. Comparison of these data with biological responses indicated that effects of dredge disposal on benthos are not limited to mechanical ones. (Peters-PTT)
W86-05152

EFFECTS OF HYDRAULIC DREDGING TO CONTROL OYSTER DRILLS ON BENTHIC MACROFAUNA OF OYSTER GROUNDS IN DELAWARE BAY, NEW JERSEY,
Rutgers Shellfish Research Lab., Port North Norris, NJ.
N. S. Ismail.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 3, p 379-395, 1985. 5 tab, 4 fig, 37 ref.

Descriptors: *Benthos, *Dredging, *Oysters, *Delaware Bay, New Jersey, Seasonal variation, Species diversity.

The extent and nature of the effects of hydraulic dredging to control oyster drills (Urosalpinx cinerea and Eupleura caudata, Family Muricidae, Order Neogastropoda) on benthic macrofauna and sediments of oyster grounds were studied in Delaware Bay, New Jersey. The immediate effects of hydraulic dredging were reductions in numbers of species as well as in total numbers of animals on the three oyster grounds selected. However, oyster drills were most affected. The hydraulic dredge did not totally remove any of the species present on the dredged grounds, but only decreased their densities. Repopulation of the species to control levels or to predredging levels was evident three months after dredging on Ground 515 which was dredged late April and early May. Repopulation on Laboratory Ground which was dredged during October, was evident 10 months after dredging. Apparently dredging the oyster grounds in early spring has greater advantages than dredging any other time of the year. Oyster drills are removed before they start ovipositing egg cases and benthic populations can recover completely during the remainder of the spring and during the summer. (Peters-PTT)
W86-05153

CLEARANCE RATES OF CRUSTACEAN MACROFILTRATORS: THE NATURE OF IN SITU RATE DEPRESSIONS IN A FERTILIZED OLIGOTROPHIC LAKE IN THE KUOKKEL AREA, NORTHERN SWEDEN,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
G. Persson.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 4, p 335-358, 1985. 7 tab, 4 fig, 76 ref.

Descriptors: *Crustaceans, *Oligotrophic lakes, *Limnology, *Phytoplankton, *Eutrophic lakes, Fertilization, Algae, Seston, Lake Stugsjon, Lake Hymenjaure, Sweden, Radioactive tracers, Zooplankton, Subarctic zone, Particle size.

Lake seston labelled by (14)CO2, (14)C-actate and (32)PO4 in parallel was used in zooplankton feeding experiments and checked for size distribution of the labelled particulates. Lake Stugsjon (reference) and Lake Hymenjaure were included in a lake fertilization program in the Kuokkel area in northern Sweden during the years 1971 to 1976. The lakes are situated close together at the timberline and have very similar temperatures and an icefree period of 100 to 130 days. A chrysophycean phytoplankton community normally exists in these lakes. The in situ experiments were designed to determine if depressed Eudiaptomus and Holopedium clearance rates, in an artificially fertilized lake where seston was dominated by micro-algae, were due to low retention of such algae. Addition of a labelled reference alga (Chlamydomonas sp.) was used to discover if high food concentrations (above the Incipient Limiting Concentration) or toxins caused the depressions. Clearance rates mostly ranked highest for CO2-labelled seston followed by (32)P and (14)C-acetate labelled seston, reflecting approximately the size distribution of the labelled food. Clearance rates for the added reference alga were high and similar in the fertilized lake and in an oligotrophic reference lake. It is concluded that the detection rate depression is explained purely by poor retention of small particles (passive size selection) by the crustaceans studied, but that active food selection offers optional explanations of the experimental results. (Peters-PTT)
W86-05154

ENVIRONMENTAL EFFECTS ON SPECIFIC RATE OF PHOTOSYNTHESIS IN SMALL FERTILIZED LAKES (NORTH-WEST OF THE USSR),
Gosudarstvennyi Nauchno-Issledovatel'skii Inst. Ozernogo i Rechnogo Rybnogo Khozyaistva, Leningrad (USSR). Dept. of Hydrobiology.
T. V. Tereshenkova.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 4, p 453-470, 1985. 4 tab, 9 fig, 28 ref.

Descriptors: *Phytoplankton, *Photosynthesis, *Lakes, *Limnology, *Biomass, Temperature effects, Russia, Leningrad, Seasonal variation, Diurnal variation, Algae, Fertilizers, Nutrients.

Results of long-term integrated studies performed on 8 shallow water fertilized small lakes from 1975 to 1981 revealed a distinct direct dependence of the specific rate of photosynthesis on temperature. The studies were performed in the Leningrad district (Luga region) on 8 lakes of the Syaber group: Pelyuga, Bakhmanskoe, Malyi Okunyenok, Bolshoi Okunyenok, Muzha, Lyubevoe, Dryvyaty, and Naroch. During the period from summer to autumn, the mean temperature coefficient was 1.7, the recorded temperature range was 4 to 22 C, and the biomass range was 0.1 to 8.2 grams/cu m. In spring, no distinct dependence was found between the values of the diurnal P/B coefficients and the temperature. The influence of temperature on the photosynthetic activity of the algae was very distinct when the former changed. Higher photosynthetic activity of the phytoplankton is characteristic of the lakes during the early vegetation period and is induced by many favorable factors. From spring to autumn this activity usually declines. However, isolated high P/B coefficients can also be recorded in summer and autumn. For small lakes, there was a direct connection between the specific rate of photosynthesis and the coefficient of the open water area. High rates of turnover of the phytoplankton biomass in the experimental lakes are due to the shallow water factor, steady replenishment with nutrients (mineral fertilizers), relatively low values of the phytoplankton biomass and the predominance of small forms in most lakes. (Peters-PTT)
W86-05155

AVAILABILITY OF PHOSPHORUS AND THE SPECIES COMPOSITION OF THE SPRING PHYTOPLANKTON IN LAKE ERKEN,
Uppsala Univ. (Sweden). Limnologiska Institutionen.
K. Pettersson.

Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 4, p 527-546, 1985. 6 tab, 10 fig, 39 ref.

Descriptors: *Phytoplankton, *Eutrophic lakes, *Limnology, *Phosphorus, *Lake Erken, Sweden, Ice, Dinoflagellates, Algae, Diatoms, Species diversity, Seasonal variation, Biochemical tests, Enzymes, Fluorometry, Photometry.

The spring development of phytoplankton and the phosphorus content were monitored intensively in Lake Erken, a moderately eutrophic lake in central Sweden which is regularly covered with ice for about 18 weeks from January to late April, during the springs of 1979 and 1980. The dominant species were dinoflagellates, mainly Woloszynskia ordinata and Peridinium aciculiferum, during the entire spring of 1979. The long period of ice cover favored the motile species, which were able to utilize the available light immediately below the ice. A considerable migration was noticed in March 1979. These large and slow growing algae were able to store phosphorus,and surplus phosphorus concentrations up to 12 micrograms P/liter were measured, which corresponds to an algal content of 10 micrograms P/mg C. These values were more than twice as high as those recorded earlier in Lake Erken. Although a spring outburst of diatoms did not occur in 1979 and 1980, the algae were phosphorus limited in May, as indicated by high alkaline phosphatase activity, low algal surplus phosphorus content and high inorganic N:P ratios. It is concluded that phosphorus is important for the development of the spring phytoplankton. (Author's abstract)
W86-05156

PRIMARY PRODUCTION AND EFFECTS OF ENRICHMENT WITH NITRATE AND PHOSPHATE ON PHYTOPLANKTON IN THE BARRA BONITA RESERVOIR (STATE OF SAO PAULO, BRAZIL),
Universidade Federal de Sao Carlos (Brazil). Dept. of Zoology.
R. Henry, K. Hino, J. G. Gentil, and J. G. Tundisi.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 4, p 561-573, 1985. 1 tab, 11 fig, 24 ref.

Descriptors: *Barra Bonita reservoir, *Limnology, *Nitrates, *Phosphates, *Phytoplankton, *Reservoirs, *Primary productivity, Chlorophyll, Sao Paulo, Brazil, Photosynthesis, Surface, Biomass, Nutrients, Aphatic zone.

The construction of reservoirs for the generation of electricity has increased during the past 20 years in Brazil. The creation of artificial ecosystems, distributed over various catchment areas and at various latitudes and longitudes, provides an opportunity to develop comparative limnological studies. Primary productivity of phytoplankton was evaluated by the (14)C and dissolved oxygen methods in December 1981 at the Barra Bonita Reservoir (Sao Paulo State, Brazil). The primary production varied between 0.17 to 14.51 mg C/cu meter/hr at 4 and 0 meters depth, respectively. About 57 to 94% of the photosynthetic activity was due to phytoplankton >50 micrometers. The highest value of assimilation rate was found in the surface water. Dissolved nutrient concentrations were very high and consisted mainly of nitrate. Light penetration was low, the aphotic zone accounted for 90% of the water column. Enrichment with nitrate and phosphate showed that both N and P stimulated the production of biomass (chlorophyll alpha), mainly due to the addition of phosphate. The enrichment experiment also indicated that phosphate addition has a significant stimulatory effect on the growth of Melosira sp. The limiting effect of light penetration on photosynthetic activity is more severe than that of nutrients. (Peters-PTT)
W86-05157

ANALYSIS OF THE BIOTIC COMMUNITY IN A KUMAUN HIMALAYAN LAKE, NAINITAL (U.P.), INDIA,
Kumaun Univ., Naini Tal (India). Dept. of Zoology.
M. C. Pant, A. P. Sharma, P. C. Sharma, and P. K. Gupta.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 4, p 591-602, 1985. 5 tab, 6 fig, 30 ref.

Descriptors: *Phytoplankton, *Eutrophic lakes, *Zooplankton, *Limnology, *Eutrophication, *Lake Nainital, Macrozoobenthos, Mud-water interface, Dissolved oxygen, Respiration, India, Biomass, Seasonal variation, Fish, Mortality, Benthos, Species diversity.

In the last 2 or 3 decades, due to intensive man made modifications in its catchment basin, Lake Nainital has undergone a considerable limnological evolution. The impact of eutrophication on the structure and function of the plankton and benthos communities of the lake was investigated. A comprehensive study of phyto- and zooplankton and macrozoobenthic components in Lake Nainital showed that species richness was high for plankton and low for macrozoobenthos. Fish mortality is high every winter due to severe depletion of dissolved oxygen during the cold season. The algal biomass is dominated by greens (54%) and bluegreen (31%), the zooplankton population by copepods (84%), and the macrozoobenthic community by a Tubilex-Chironomus association constituting > or = 95% of the annual number of the macrobenthic invertebrates. Respiration surpassed gross production. The mean annual ratio between phyto- and zooplankton biomass is 3.3 and between phytoplankton and herbivores is 4.6. If biomass is treated as a measure of crude production, the relationship among the three trophic levels suggests that herbivory is inefficient while carnivory is efficient. The low diversity of different biotic components and the P/R ratio of <1 suggest that the lake is passing through the stage of heterotrophic succession. (Peters-PTT)
W86-05159

MEASURE OF PLANKTON COMMUNITY SIMILARITY UTILIZING VARIABLE WEIGHTING OF TOTAL DENSITY AND TAXONOMIC PROPORTIONALITY,
Ontario Ministry of the Environment, Rexdale.
For primary bibliographic entry see Field 2H.
W86-05160

CHEMICAL AND MICROBIOLOGICAL PROCESSES AS REGULATORS OF THE EXCHANGE OF SUBSTANCES BETWEEN SEDIMENTS AND WATER IN SHALLOW EUTROPHIC LAKES,
Swedish Environmental Research Inst., Stockholm.
S.-O. Ryding.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 5, p 657-702, 1985. 8 tab, 21 fig, 115 ref.

Descriptors: *Eutrophic lakes, *Sediments, *Phosphorus, Temperature effects, Sweden, Anaerobic conditions, Seasonal variations, Chelation, Shallow water, Morphology, Hydrology.

It is generally believed that excessive phosphorus release from lake sediments, i.e., internal P load, is only a problem in deep lakes with stagnant anaerobic bottom waters. However, substantial amounts of P can also be released from sediments in shallow, well-mixed lakes. The dynamics and magnitude of P release from sediments in these types of lakes are affected primarily by physical factors, such as seasonal variations in water temperature and year to year differences in water renewal. These factors, in turn, induce chemical and microbiological processes which regulate the exchange of substances between sediments and water. The fractional distribution of sedimentary P and the chelating capacity of the water are also important factors that can provide insights to the processes involved and their quantitative impact on the P status in shallow, eutrophic lakes. Morphological and hydrological features of the following lakes were examined: Boren, Djolosjon, Finjasjon, Glaningen, Garan, Hacklasjon, Kalven, Malmsjon, N. Bergundasjon, Nasbysjon, Ramsjon, Ryssbysjon, Satoftasjon, S. Bergundasjon, V. Ringsjon, and O. Ringsjon. (Peters-PTT)
W86-05161

INFLUENCE OF COPPER IN VARIOUS FORMS ON NATURAL PHYTOPLANKTONIC POPULATIONS FROM THE SAGUENAY RIVER, QUEBEC, CANADA. (INFLUENCE DE LA SPÉCIATION DU CUIVRE SUR LES POPULATIONS PHYTOPLANCTONIQUES NATURELLES DE LA RIVIERE DU SAGUENAY, QUEBEC, CANADA.),
Quebec Univ., Chicoutimi. Dept. des Sciences Fondamentales.
P.-A. Thompson, and R. Cote.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 5, p 711-731, 1985. 3 tab, 6 fig, 44 ref.

Descriptors: *Copper, *Phytoplankton, *Algae, *Toxicity, *Saguenay River, Quebec, Canada, Chlorophycea, Chlorophyll, Photosynthesis, Diatoms, Humic acid, Dissolved organic matter, Cellulose fibers, Species diversity, Estuaries, Primary production.

Experiments to study the toxicity of copper in its ionic, complexed (to humic acid) and adsorbed (on cellulose fibers from a local paper mill) forms on species composition, standing crop, and photosynthesis of phytoplankton were conducted in chemostats with natural aggregations composed mainly of either green algae or of diatoms from the Saguenay River. The Saguenay River is situated in an industrialized area (aluminum smelters, paper mills), and it receives both industrial and urban wastewaters. Experiments conducted in July and September 1981 with populations composed mainly of Chlorophyceae showed Chlorella sp. to be quite tolerant to copper; however, when copper concentrations were high (50 and 100 mg/l ionic copper), Nitzschia palea became the dominant species. Primary production is more strongly inhibited by copper than is chlorophyll alpha concentration. In November 1981, experiments with diatoms from the Saguenay River showed that of the species present, Asterionella formosa, is the species most sensitive to copper, whereas Melosira islandica is the least sensitive. Copper has a strong negative effect on the cell densities, standing crop and photosynthesis of the diatom populations. The addition of humic acid, and to a lesser degree, cellulose fibers significantly reduced the toxicity of copper. The relatively high concentrations of dissolved organic matter and suspended cellulose fibers in the waters of the Saguenay River are probably important factors controlling the toxicity of copper to the phytoplankton of this estuary. (Peters-PTT)
W86-05162

COMPARATIVE LIMNOLOGY OF SEVERAL RESERVOIRS IN CENTRAL INDIA,
Government Post Graduate Coll., Chhindwara (India). Dept. of Botany.
K. S. Unni.
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 6, p 845-856, 1985. 4 tab, 1 fig, 23 ref.

Descriptors: *Reservoirs, *Chemical composition, *Limnology, Vegetation, Electrical conductivity, Calcium, Carbonate, Chloride, Phytoplankton, Zooplankton, Eutrophication, Oligotrophy, Mesotrophy, Morphology, Transparency, Rotifers.

Twenty four reservoirs in Central India were investigated for their physical, chemical and biological features. The reservoirs were located in the state of Madhya Pradesh. These reservoirs differed significantly in their size, physical features, chemical composition and vegetation. Three medium and three major reservoirs recorded comparatively low electrical conductivity. All the 18 minor reservoirs showed high conductivity and low transparency since they were all situated in densely populated urban areas polluted by human feces and domestic sewage. The most abundant ions in water are calcium, carbonate and chloride. The phytoplankton was found to be dominated by Cyanophyceae. Rotifers dominated among zooplankton. All the minor reservoirs are highly eutrophicated. Among the major reservoirs Tawa Reservoir is oligotrophic while others are mesotrophic to eutrophic in nature. (Peters-PTT)

W86-05164

EVOLUTION OF BACTERIAL POPULATIONS IN SALT MARSH SEDIMENTS OF ILE GRANDE POLLUTED BY AMOCO CADIZ. (EVOLUTION DES POPULATIONS BACTERIENNES DANS LES SEDIMENTS DES MARAIS MARITIMES DE I'ILE GRANDE POLLUES PAR L'AMOCO CADIZ).
Endoume Marine Station and Oceanography Centre, Marseille (France).
Internationale Revue der Gesamten Hydrobiologie, Vol. 70, No. 6, p 815-827, 1986. 10 fig, 23 ref.

Descriptors: *Oil spills, *Salt marshes, *Sediments, Ile Grande, Oil pollution, Microbial activity, Alkanes, Heterotrophic bacteria.

Microbial investigations on heterotrophic bacteria (MPN counts, adenylates charge, growth rate and enzymatic activities) and hydrocarbon utilizing microorganisms (MPN counts) were carried out during 3 yr in the salt marshes of Ile Grande. The aim was to follow their recovery after oil pollution. Three years after oiling, the amount of Amoco Cadiz oil in the surface level of some Juncus maritimus meadows of Ile Grande remains very high. In other biotopes a variable decline in concentrations has been observed. These differences are linked to differences in microbial activities. Microbial activity is low in the asphalt-like pavement characteristic of higher meadows where alkanes have been removed. Activity has been nearly destroyed in heavily polluted meadows where alkanes are still present. In the surface layer of creeks and mud flats, microbial activity is high and hydrocarbons are well degraded. The results for the 3 yr show a significant enhancement of the microflora during the first year (corresponding to removal of n. alkanes) followed by a decrease in bacterial activity which persisted for >2 yr. The activity of the heterotrophic bacterial population is deeply disturbed compared with unoiled sites, and these shifts remain detectable 3 yr after oiling. This study does not modify previous estimations regarding the recovery of the salt marshes. (Peters-PTT)
W86-05167

VERTICAL MIGRATION AND MORTALITY OF MARINE BENTHOS IN DREDGED MATERIAL: A SYNTHESIS,
Delaware Univ., Lewes. Coll. of Marine Studies.
D. Maurer, R. T. Keck, J. C. Tinsman, W. A. Leathem, and C. Wethe.
International Revue der Gesamten Hydrobiologie, Vol. 71, No. 1, p 49-63, 1986. 2 tab, 36 ref.

Descriptors: *Benthos, *Spoil banks, *Sediment, Sand, Silt, Vertical distribution, Invertebrates, Temperature effects, Mollusks, Amphipods, Crustaceans, Geochemistry, Polychaetes, Dredging, Mortality.

The responses of the species of benthic invertebrates to burial in terms of migration ability or mortality were compared, and a synthesis and recommendations for assessing future impacts were provided. The four species compared were the bivalve Mercenaria mercenaria, the amphipod crustacean Parahaustorius longimerus, and the polychaetes Scoloplos fragilis and the Nereis succinea. There was evidence of synergistic effects on burrowing activity and mortality with changes in time of burial, sediment depth, sediment type, and temperature. N. succinea was the most resistant species followed by M. mercenaria, S. fragilis, and P. longimerus in sediment with silt-clay. In sediment without silt-clay the order of percent mortality was reversed. Dissolved oxygen decreased and ammonia and sulfide increased between the surface and below 2.0 cm within a 15-day period. M. mercenaria and N. succinea should be relatively resistant to chemical effects of spoil disposal and S. fragilis and P. longimerus would be less resistant. Vertical migration of benthic invertebrates through dredged disposal can be a viable mechanism of recolonization under certain conditions. Some effects of burial of benthos can be predicted based on morphology, behavior, and physiology. These biological features are discussed with examples dealing with molluscs, crustaceans, and polychaetes. (Peters-PTT)

W86-05169

FATTY ACIDS IN LIPIDS FROM PARTICULATE ORGANIC MATTER IN A EUTROPHIC LAKE, LAKE NAKANUMA, JAPAN,
Tsukuba Univ. (Japan). Inst. of Biological Sciences.
T. Miyazaki, J. Irie, Y. Ogawa, and S.-E. Ichimura.
International Revue der Gesamten Hydrobiologie, Vol. 71, No. 1, p 101-113, 1986. 2 tab, 5 fig, 43 ref.

Descriptors: *Eutrophication, *Fatty acids, *Eutrophic lakes, *Limnology, *Particulate matter, *Phytoplankton, Lake Nakanuma, Japan, Myristic acid, Linoleic acid, Palmitic acid, Palmitoleic acid, Linoleic acid, Oleic acid, Stearic acid, Lakes, Seasonal variation, Photosynthesis, Water depth, Mixing.

Seasonal changes in the amounts of fatty acids in lipids of suspended particulate organic matter were investigated in a eutrophic lake, Lake Nakanuma, Japan. Fatty acids were distributed uniformly throughout the whole water column during the mixing period, and their concentrations were between 28 and 46 micrograms/liter. During the summer stagnation period, concentration maxima of 60 to 80 and 60 to 100 micrograms/liter appeared in the near-surface and metalimnetic layers, respectively. The depth of the shallower maximum seemed to correspond to that of the photosynthetic maximum. Major fatty acids were myristic, palmitic, palmitoleic, and oleic acids. Stearic acid was a minor component. Linoleic acid, linolenic and eicosa pentaenoic acids were less abundant, but their percentage remained relatively constant. (Peters-PTT)
W86-05171

ANALYSIS OF THE INSHORE MACROZOOBENTHIC COMMUNITY IN LAKE NAINI TAL, UP, INDIA,
Kumaun Univ., Naini Tal (India). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W86-05172

FIELD AND LABORATORY STUDIES ON NILE PHYTOPLANKTON IN EGYPT. I. SOME PHYSICAL AND CHEMICAL CHARACTERISTICS,
Assiut Univ. (Egypt). Dept. of Botany.
For primary bibliographic entry see Field 2H.
W86-05173

PHYTOPLANKTON PRODUCTIVITY IN TURBID WATERS,
Orange Free State Univ., Bloemfontein (South Africa). Inst. of Environmental Sciences.
J. U. Grobbelaar.
Journal of Plankton Research JPLRD9, Vol. 7, No. 5, p 653-663, September 1985. 6 fig, 3 tab, 22 ref.

Descriptors: *Turbidity, *Primary productivity, *Suspended sediments, *Euphotic zone, *Phytoplankton, Inorganic particles, Wuras Dam, Mixing layers, Photosynthesis, Aphotic zone, Respiration.

Many of the freshwater areas in the world are turbid, due to suspended inorganic particles. The effects of turbidity on measurements of primary productivity was investigated using test tubes of various lengths. The euphotic depth of the shallow turbid impoundment, Wuras Dam, varies between 0.3 and 1.3 meters. A plexiglass tube the depth of the euphotic zone confined the phytoplankton in the light and the rates measured represent the maximal possible under the prevailing conditions. Longer tubes include an aphotic portion and give an idea of the magnitude of respiration losses. The depth of the mixing layer appears to be especially important in turbid systems as the time spent in the dark, relative to the light is of great importance and may be the most important regulating factor in such waters. (Peters-PTT)
W86-05177

REGULATION OF BACTERIAL SECONDARY PRODUCTION IN TWO EUTROPHIC LAKES AND IN EXPERIMENTAL ENCLOSURES,
Copenhagen Univ., Hilleroed (Denmark). Det Ferskvands-Biologiske Lab.
B. Riemann, and M. Sondergaard.
Journal of Plankton Research JPLRD9, Vol. 8, No. 3, p 519-536, May 1986. 10 fig, 1 tab, 42 ref. Danish Natural Science Research Council J. No 11-1816, 11-4758.

Descriptors: *Eutrophic lakes, *Limnology, *Phytoplankton, *Experimental basins, *Bacteria, Biomass, Lake Hylke, Lake Skanderbag, Denmark, Phosphates, Fish, Algae, Organic carbon, Radioactive tracers, Tritium, Phytotoxicity.

Changes in bacterial production and biomass in two eutrophic lakes were examined in relation to changes in phytoplankton biomass, and primary production and release of extracellular organic carbon (EOC). Bacterial cell number and secondary production of bacterioplankton were measured during two periods of 14 and 19 days, respectively, in experimental enclosures of lake water, and in two Danish eutrophic lakes. One lake was Lake Hylke (part of Lake Skanderborg) situated in the central part of Jutland and the second was Frederiksborg Slotsso in the northern part of Zealand, Denmark. Additions of phosphate and planktovorous fish in some of the enclosures induced rapid changes in the phytoplankton biomass, primary production and release of EOC. In some of the enclosures containing fish, release of EOC from phytoplankton constituted from 36 to 55% of the bacterial secondary production, determined by means of (3-H) thymidine incorporation into DNA. In others, this relationship was not found, suggesting that phytoplankton species-specific release rates of composition of EOC might play a role in the microbial response. In enclosures without fish, released dissolved organic carbon from zooplankton grazing activities could sustain > or = 32% of the bacterial production. Algal senescence, induced by phosphate depletion, also created large increases in bacterial secondary production. Changes in the growth of pelagic freshwater bacteria are controlled by a variety of events occurring on several trophic levels as well as in the nutrient regime. (Peters-PTT)
W86-05186

IMPACT OF THE IXTOC-1 OIL SPILL ON ZOOPLANKTON,
Instituto Politecnico Nacional, Mexico City. Escuela Nacional de Ciencias Biologicas.
S. A. Guzman del Proo, E. A. Chavez, F. M. Alatriste, S. de la Campa, and G. de la Cruz.
Journal of Plankton Research JPLRD9, Vol. 8, No. 3, p 557-581, May 1986. 22 fig, 3 tab, 17 ref.

Descriptors: *Zooplankton, *Oil spills, *Environmental impact, Ixtoc-1, Gulf of Mexico, Campeche City, Terminos Lagoon, Estuaries, Hydrocarbons, Plankton, Grijalva River, Usumacinta River, Mexico, Biomass, Seasonal variation.

The impact of the Ixtoc-1 oil spill on the zooplankton community in the southern part of Gulf of Mexico was assessed. Zooplankton data taken from seven cruises between 1979 and 1982 show a decrease in biomass levels of almost four orders of magnitude, lower than previously observed when mean biomass reached 389 mg/m. Seasonal biomass changes observed before and after the spill shown the same pattern, with a maximum in the summer, and a minimum in the spring. Together with specific diversity, the highest heterogeneity of the community was a present in the spring and the lowest diversity in the fall. Areas of high plankton productivity are the coastal zones in Campeche City, Terminos Lagoon and off the estuaries of Grijalva and Usumacinta rivers. Changes in the organization and structure of the zooplankton community occurred after the spill, reaching a lower level of stability. Most samples appear to be contaminated by hydrocarbons, but the role of the Ixtoc-1 oil spill as a factor in this is hard to determine. Decay of oil in zooplankton occurs exponentially, with persistent levels of aliphatic hydrocarbons suggesting a persistent pollution source, with damaging effects on plankton

lower than those produced by the Ixtoc-1. The accident at the Ixtoc-1 oil well, according to official figures, spilled 3.1 million barrels through a 10-month period, starting in June 1979. (Peters-PTT)
W86-05187

THERMAL AND OXYGEN CONDITIONS AND THE CHEMICAL COMPOSITION OF THE WATER IN THE GREAT MASURIAN LAKES,
Instytut Rybactwa Srodladowego, Olsztyn-Kortowo (Poland).
B. Zdanowski, A. Korycka, and J. Zachwieja.
Ekologia Polska, Vol. 32, No. 4, p 651-677, 1984. 6 fig, 4 tab, 37 ref.

Descriptors: *Trophic level, *Limnology, *Physicochemical properties, *Chemical composition, *Chlorophyll, Great Masurian lakes, Phytoplankton, Biomass, Phosphorus, Temperature, Nitrogen, Eutrophication, Wegorapap River, Pisa River, Poland, Agricultural watersheds, Forest watersheds, Epilimnion, Hypolimnion.

The trophic state of the lakes of the Great Masurian Lakes complex Poland, was analyzed based on investigations carried out only once during the summer stagnation period (July 1976). The physicochemical condition of the water, visibility of Secchi's disc and chlorophyll content in 21 lakes was examined and compared with literature data for the last several years. In the meta- and hypolimnion of polluted lakes deteriorated oxygen conditions were found. Near the upper range of the thermocline an acute oxygen deficit was found. The chemical composition of the water in the lakes was correlated with the degree of development of the drainage area. The lakes in an agricultural drainage area were characterized by an advanced state of eutrophication. The lowest concentrations of mineral salts and hence the lowest state of eutrophication, were seen in the forest drainage area. Phytoplankton biomass, chlorophyll content, and water transparency were correlated with the content of phosphorus in the epilimnion. (Peters-PTT)
W86-05194

RESIDUES OF ORGANOCHLORINE INSECTICIDES IN FISH FROM POLLUTED WATER,
Biological Research Center, Baghdad (Iraq).
For primary bibliographic entry see Field 5B.
W86-05264

GROWTH AND PHOTOSYNTHETIC RESPONSE OF A FRESHWATER ALGA, SELENASTRUM CAPRICORNUTUM, TO AN OIL SHALE BY-PRODUCT WATER,
University of Wyoming Research Corp., Laramie. Western Research Inst.
D. Delistraty.
Bulletin of Environmental Contamination and Toxicology, Vol. 36, No. 1, p 114-121, January 1986. 3 tab, 21 ref.

Descriptors: *Selenastrum capricornutum, *Oil shale, *Industrial wastes, Photosynthesis, Algal toxins, Bioindicators, Chemical analysis, Biological assays, Toxicity.

Toxicological research and development of effective control technologies are needed to identify and minimize the environmental impact of complex by-product waters generated during in situ recovery of shale oil. Using a standard algal species, such as Selenastrum capricornutur, provides a systematic approach to toxicant evaluation. Chemical fractionation and short-term bioassays is the approach used in this study to compare the growth and photosynthetic response of S. capricornutum to an oil shale by-product water and its organophilic and hydrophilic subfractions. Based on median effective concentration values, toxicity ranked at follows: organophilic > hydrophilic > oil shale by-product water (growth experiment) hydrophilic > oil shale by-product water > organophilic (photosynthesis experiment). The data obtained in this study indicate that concentrations above 2% whole oil shale water are inhibitory to algae. Chemical fractionation provided more detailed toxicity information than whole water analysis alone. Furthermore, the longer-term growth experiment provided greater sensitivity than the rapid photosynthesis test. As a screening tool the five-day algal growth assay was more diagnostic than the four-hour photosynthesis test when combined with chemical fractionation. (Main-PTT)
W86-05265

EFFECTS OF ENDOSULPHAN ON THE HYPOTHALAMO HYPOPHYSIAL COMPLEX AND FISH REPRODUCTIVE PHYSIOLOGY,
Government Coll., Sendhwa (India). Dept. of Zoology.
L. Shukla and, and A. K. Pandey.
Bulletin of Environmental Contamination and Toxicology, Vol. 36, No. 1, p 122-131, January 1986. 16 Fig, 1 tab, 24 ref.

Descriptors: *Endosulphan, *Hypothalamo-hypophysial complex, *Fish physiology, Tissue analysis, Insecticides, Fish populations.

It is essential to work out the damages caused by the insecticides at lower concentration in the fish endocrine physiology in relation to fish reproduction and culture. This study aims to assess the histophysiological lesions produced by endosulphan in the hypothalamo-hypophysical complex ovarian axis in Sarotherodon mossambicus. The insecticide endosulphan was dissolved in acetone and added to 20 l aquarium water for preparing 0.001 ppm concentration of insecticide. Water was changed on every third day with an aim to keep the fish in a constant concentration of this insecticide. Histological and histochemical studies were performed on the pituitary gland and ovaries. The 3 beta and 17 beta HSDH (steroid dehydrogenase activity) was studied. The activity of the pituitary gland was assessed by calculating the area of cyanophils and acidophils by occulometer and tinctorial details. The diameter of nucleus preopticus and nucleus lateralist ubaries was also recorded. In the ovary, the percentage and diameter of oogonia were calculated. Endosulphan treated fish showed many histological and histochemical changes. This study suggests that the aquatic medium in which the fish lives, when it is contaminated with endosulphan results in changes in oxygen content and pH and also in other physico-chemical factors of water, probably these interfere with the reproductive mechanisms in this fish. (Main-PTT)
W86-05266

IMPAIRMENT OF THYROID ACTIVITY IN SAROTHERODON MOSSAMBICUS DUE TO DDT TREATMENT,
Government Coll., Sendhwa (India). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W86-05267

IN VIVO METABOLISM OF FENITROTHION (0,0-DIMETHYL-0-(4-NITRO-M-TOLYL) PHOSPHOROTHIOATE) IN FRESH WATER TELEOST (TILAPIA MOSSAMBICA),
Regional Research Lab., Hyderabad (India). Entomology and Toxicology Div.
For primary bibliographic entry see Field 5B.
W86-05268

DIFFUSION THROUGH A DOUBLE-SIDED PLATE: DEVELOPMENT OF A METHOD TO STUDY ALGA-BACTERIUM INTERACTIONS,
Northern Arizona Univ., Flagstaff. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W86-05277

PUBLIC HEALTH SIGNIFICANCE OF INDUSTRIAL POLLUTION IN ZARIA, NIGERIA,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Veterinary Public Health and Preventive Medicine.
A. O. Oganga, and D. Abijoroh.
Royal Society of Health Journal, Vol. 105, No. 6, p 211-215, December 1985. 3 tab, 8 ref, 2 append.

Descriptors: *Public health, *Industrial pollution, *Zaria, *Nigeria, Air pollution, Water pollution, Land disposal, Industrial wastes, Malaria, Gastroenteritis, Solid wastes, Sludges, Chemical wastes, Water pollution effects.

Pollution factors and pollution loads associated with rapid industrial growth is related to the health of local inhabitants reporting to a university teaching hospital. Industries involved included tarpaulin making, corrugated cardboard making, cigarette making, leather tanning, foam making, and slaughter houses. The problems of water pollution have been accentuated by the speed of population growth and industries as well as by changing technologies and new agricultural practices. The uncontrolled disposal of sewage and other liquid wastes resulting from domestic uses of water, sediment from land erosion, minerals and chemicals from industrial wastes, insecticides, pesticides, detergents, radioactive substances and heat from power and industrial plants are considered as sources of water pollution. When these solid wastes and sludges from chemical works and industries containing toxic metals such as lead, tin, zinc, iron, and mercury are allowed to flow from factories without prior treatment, the toxic or poisonous materials will be leached out and ultimately reach water sources. Liquid and solid wastes for each industry are quantified. The incidence of diseases associated with environmental pollution are reported, with malaria and gastroenteritis highest. (Lantz-PTT)
W86-05301

COOLING TOWER EVAPORATION OF TREATED COAL GASIFICATION WASTEWATERS,
Pittsburgh Univ., PA. School of Engineering.
For primary bibliographic entry see Field 5D.
W86-05313

BEHAVIORAL ASSAY FOR ASSESSING EFFECTS OF POLLUTANTS ON FISH CHEMORECEPTION,
Saskatchewan Univ., Saskatoon. Dept. of Biology.
A. D. Lemly, and R. J. F. Smith.
Ecotoxicology and Environmental Safety, Vol. 11, No. 2, p 210-218, April 1986. 4 fig, 15 ref.

Descriptors: *Water pollution effects, *Computers, *Monitoring, *Fish behavior, *Hydrogen ion concentration, Bioassay, Fathead minnows, Ecological effects, Automation, Fish toxins, Assay, Fish physiology.

A system that assesses the response of fish to sublethal levels of pollutants was used to examine the effects of reduced pH on the response of fathead minnows to chemical feeding stimuli. The observation system consists of a special aquarium coupled to a recirculating water system, and an Opto-Varimex-Aqua activity tracking meter interfaced to a microcomputer. The tracking meter forms an intersecting, planar grid of light beams which, when interrupted by fish movements, is translated into a digitized signal and fed to the computer. The assay is based on the response of fish to natural chemical stimuli such as food odors or pheromones. When these stimulus solutions are injected into the water circulation the response of the fish is monitored by the computer system, which is capable of discriminating and quantifying changes in eight parameters. Normal responses to stimuli are compared with the response of fish that have been exposed to pollutants. The system should be easily adapted to any laboratory engaged in testing for effects of toxic substances, and will identify effects of pollution that have thus far been difficult or impossible to assess. (Geiger-PTT)
W86-05325

EFFECT OF AL AND HUMIC ACIDS ON THE 241 AM ADSORPTION ON THE EXOSKELETON OF THE CRAYFISH ASTACUS LEPTODACTYLUS ESCHSCHOLTZ,
Antwerp Univ., Wilrijk (Belgium).
For primary bibliographic entry see Field 5B.
W86-05328

INFLUENCE OF WATER ON REPRODUCTIVE SUCCESS AND CHEMICAL COMPOSITION

OF LABORATORY REARED POPULATIONS OF DAPHNIA MAGNA,
Dow Chemical U.S.A., Midland, MI. Dept. of Environmental Quality.
U. M. Cowgill, H. W. Emmel, D. L. Hopkins, S. L. Applegath, and I. T. Takahashi.
Water Research, Vol. 20, No. 3, p 317-323, March 1986. 8 tab, 16 ref.

Descriptors: *Water pollution effects, *Daphnia, *Foods, Reproducibility, Rivers, Chemical properties, Lakes, Statistical analysis, Industrial wastewater, Trace elements, Conductivity, Ecological effects, Toxicity.

The purpose of this study was to examine the effect of two types of natural water and one processed water on the reproductive success of Daphnia magna. It was also of interest to discover whether the chemical composition of the water or that of the food was more important in determining the chemical composition of the organisms. To achieve this purpose 50 neonates per water type were reared to maturity. Their progeny were enumerated every other day. The study lasted 4.5 weeks. In addition, neonates were batch cultured in each water for 4 weeks. These random aged populations, with no individual older than 28 days, were analyzed for their elemental content. Sodium, K. Cu, Mg, Ca, Zn, P, S, Se, Mo, Cl, Fe, Mn, Co and Ni were measured in random populations of D. magna grown in each of the three waters, neonates and adults reared in processed and one natural water and finally, in the three waters themselves. Linear correlation coefficients were calculated among all the variables. Partial correlation coefficients showed that the chemical composition of the organisms is determined by the chemical composition of the rearing water. The largest number of broods, the greatest total number of neonates, the largest mean brood size, the greatest number of neonates per female, occurred among populations reared in lake water. The poorest demographic results were obtained from daphnids reared to processed water. Suggestions are offered for ways in which processed water could be improved as a rearing medium for daphnids. (Author's abstract)
W86-05337

ENVIRONMENTAL PH INFLUENCES GROWTH AND TISSUE CHEMISTRY OF THE SUBMERSED MACROPHYTE VALLISNERIA AMERICANA,
State Univ. of New York at Binghamton. Dept. of Biological Sciences.
D. Grise, J. E. Titus, and D. j. Wagner.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 2, p 306-310, February 1986. 3 fig, 43 ref. EPA Grant R809436010.

Descriptors: *Hydrogen ion concentration, *Tissue analysis, *Macrophytes, *Vallisneria americana, *Water pollution effects, Wild celery, Acid waters, Nitrogen, Phosphorus, Calcium, Manganese, Aluminum, Iron, Plant growth, Plant tissues.

Wild celery (Vallisneria americana, Hydrocharitaceae) is a common submersed freshwater macrophyte rarely seen in lakes with pH below 6. Plants grown in a greenhouse on a uniform sediment within pH-controlled tanks all survived 60 days at pH 5 but showed reduced dry matter accumulation (by 76%), leaf area (by 79%), and rosette and winter bud production (by 44 and 63%, respectively) compared with plants grown at pH 7.5. The sensitivity of this plant to only moderate acidity did not differ for plants in water acidified to pH 5 by a combination of H2SO4 and HNO3 or by HCl, indicating that the former acids exerted no fertilizing effects to counter the detrimental influence of acidification. Tissue nitrogen and phosphorus levels were well above the critical concentrations previously reported for this species. Tissue calcium and manganese concentrations showed no clear relationship to treatment pH. Both aluminum and iron levels in tissues were twofold to threefold higher for the smaller plants grown at pH 5, suggesting that metal toxicity may have caused a growth reduction at low pH. (Lantz-PTT)
W86-05347

DEVELOPMENT, TESTING AND INTERCALIBRATION OF REFERENCE METHODS FOR POLLUTION STUDIES IN COASTAL AND ESTUARINE WATERS,
International Lab. of Marine Radioactivity, Monaco-Ville (Monaco).
S. R. Aston.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 27-34, 1986. 1 tab, 7 ref.

Descriptors: *Water pollution, *Estuaries, *Coastal waters, Environmental effects, Monitoring, Water analysis, Water pollution control.

Following the 1972 United Nations Conference on the Human Environment, the United Nations Environment Program (UNEP) initiated a Regional Seas Program in 1974. At present the Program involves ten regions and has over 120 coastal states participating. It is conceived as an action-oriented program having concern not only for the consequences but also for the causes of environmental degradation and encompassing a comprehensive approach to combating environmental problems through the management of marine and coastal areas. Each regional action plan is formulated according to the needs of the region as perceived by the governments concerned. One of the basic components of the regional action plans is the assessment of the state of marine pollution. For this purpose a set of Reference Methods for marine pollution studies is being developed. This paper describes the development of Reference Methods for use by participants in Regional Seas Programs, where they are intended to ensure that the data can be compared on a world-wide basis and thus contribute to the Global Environment Monitoring System (GEMS) of UNEP. The study draws on particular aspects of the development and testing of some individual Reference Methods to illustrate the problems and philosophy adopted for a project which represents a world-wide attempt to promote the detection, understanding and control of coastal and estuarine pollution. The scientific criteria for method selection and application emphasize the pragmatic approaches which are being adopted to fulfill this ambitious project. (Lantz-PTT)
W86-05354

CADMIUM AND LEAD CYCLING BETWEEN WATER, SEDIMENT, AND BIOTA IN AN ARTIFICIALLY CONTAMINATED MUD FLAT ON BORKUM (F.R.G.),
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Atlantic Oceanographic Lab.
For primary bibliographic entry see Field 5B.
W86-05365

DISTRIBUTION OF MERCURY IN THE SEDIMENTS AND FISHES OF THE LAGOONS OF AVEIRO, PORTUGAL,
Aveiro Univ. (Portugal). Dept. de Quimica.
For primary bibliographic entry see Field 5B.
W86-05366

BIOLOGICAL EFFECTS AND POLLUTION ASSESSMENT,
Marine Lab., Aberdeen (Scotland).
A. D. McIntyre.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 155-160, 1986. 21 ref.

Descriptors: *Water pollution effects, *Ecological effects, *Environmental assessment, Water pollution control, Monitoring, Research priorities.

Techniques for studying biological effects of pollution in the sea are briefly reviewed and the circumstances under which they are most useful in coastal waters considered. Some approaches are particularly suitable for studying pollution hot spots, others for detecting low levels of contamination. The role of the scientist in pollution assessment is discussed and the problems caused by lack of ecological understanding highlighted. The discussion can be summarized by the following points: (1) biological effects information is central to pollution assessment; (2) existing techniques at the level of individual organisms and lower, are useful in detecting impacts in situations of low contaminant concentrations where chemical measurements alone could be ambiguous; (3) these techniques may be amenable to utilization in broad-scale monitoring programs, and the time is ripe to test them in this context; (4) approaches at the community level are valuable in areas of high contaminant input particularly around hot spots where the input is variable and biological change can be used to delineate the extent of the effect in space; and, (5) the final assessment of an impact in terms of harm to the marine environment, although to some extent a value judgement, is one to which the scientist must contribute on the basis of his experience. (Lantz-PTT)
W86-05368

MERCURY CONTAMINATION IN COMPONENTS OF AN ESTUARINE ECOSYSTEM,
Forth River Purification Board, Queensferry (Scotland).
M. Elliott, and A. H. Griffiths.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 161-170, 1986. 3 fig, 3 tab, 31 ref.

Descriptors: *Mercury, *Water pollution effects, *Ecological effects, *Estuaries, Forth Estuary, Scotland, Sediments, Food chains, Fate of pollutants, Fish, Birds, Suspended solids, Mussels, Plankton, Fauna.

The Forth Estuary, Scotland, has received discharges containing mercury for several decades. This study describes the ecological effects of these discharges as contaminants in many components of the ecosystem, and attempts to quantify the standing mass of Hg within these components. The contaminated area is contrasted with a less-contaminated area, 19 km downstream, and shown to have significantly greater Hg levels in most components (sediments, plankton, infauna, epifauna, macroalgae and fish). The standing mass of Hg in the biota is 1% of that in the nonbiotic components (sediments, suspended material and soluble phase). Sediments alone contain 97% of the standing mass. The critical pathways in this system are: (1) the sediment-infauna-estuarine demersal fish and wading birds; and (2) suspended material-mussels-oystercatchers. Therefore, the top consumers in each of these are most at risk from increased contamination. However, in assessing the biological effects of increased contamination, there was no change at the contaminated area in fecundity in the viviparous estuarine demersal fish, Zoarces viviparus. (Author's abstract)
W86-05369

MERSEY ESTUARY (U.K.) BIRD MORTALITIES - CAUSES, CONSEQUENCES AND CORRECTIVES,
North West Water Authority, Warrington (England).
K. W. Wilson, P. C. Head, and P. D. Jones.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 171-180, 1986. 6 fig, 2 tab, 17 ref.

Descriptors: *Mersey Estuary, *Birds, *Mortality, *Water pollution effects, England, Trialkyl lead compounds, Lead, Heavy metals, Bioaccumulation, Estuaries, Ecological effects, Water pollution control, Industrial wastes, Water quality standards.

In late 1979, there was an extensive mortality among newly arrived, over-wintering populations of waders, wildfowl and gulls in the Mersey Estuary. Mortalities on this scale were unprecedented in the area and there was no obvious cause, although circumstantial evidence collected during the months following the incident indicated the probability of acute poisoning by trialkyl lead compounds. The principal source of trialkyl lead compounds was a discharge into the Manchester Ship Canal, from a factory producing tetraalkyl lead petroleum additives. Under certain conditions of freshwater flow and tidal movements, appreciable concentrations of trialkyl lead in the estuarine waters provided a suitable source for its up-take by benthic fauna and subsequently birds in amounts similar to those shown to be acutely toxic in laboratory experiments. Simple empirical models were used to calculate an appropriate effluent quality standard to protect waders and wildfowl. Full

cooperation was received from the factory concerned and the levels of trialkyl lead discharged have been reduced to the standard. Levels of alkyl lead in the water and in estuarine fauna have fallen in line with the reduced discharge. No bird mortalities attributable to alkyl lead have been observed since the lower discharge levels have been consistently achieved. (Lantz-PTT)
W86-05370

IMPACT OF TRIBUTYL TIN (TBT) ANTI-FOULING PAINTS ON MOLLUSCAN FISHERIES,
Brest Univ. (France). Lab. d'Oceanographie Biologique.
J. E. Thain, and M. J. Waldock.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 193-202, 1986. 4 fig, 3 tab, 17 ref.

Descriptors: *Tributyl tin, *Environmental effects, *Estuaries, *Water pollution effects, *Oysters, Aquaculture, Toxicity, Tin, Organic compounds, England, Mollusks, Mortality, Crouch River, Roach River.

Historically the European flat oyster, Ostrea edulis, has been the basis of an important fishery on the east coast of England, but the population has recently declined to an all-time low. Laboratory experiments have been carried out to compare larval survival, growth of spat, and the development of gametes in adult O. edulis and the growth of spat of four other bivalve species in the presence and absence of organotin toxins. The results from these experiments are discussed in relation to the concentrations or organotin compounds in samples of water and oyster tissues, from several sites in the United Kingdom, aad the reproductive behavior of adult oysters from natural stocks in the Crouch/Roach estuary system. The United Kingdom government has proposed legislation to control and reduce organotin emissions into the marine environment and this is briefly outlined. (Lantz-PTT)
W86-05372

ECOLOGICAL IMPACT OF AN OIL SPILL: UTILIZATION OF BIOLOGICAL INDICATORS,
Environmental Protection Agency, Kowloon (Hong Kong).
M. Glemarec.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 203-211, 1986. 9 fig, 14 ref, append.

Descriptors: *Oil spills, *Ecological effects, *Bioindicators, Sand, Toxicity, Hydrocarbons, Water pollution effects, Organic matter, Fauna, Biomass, Equilibrium, Degradation, Oil pollution.

The effects of the 'Amoco Cadiz' oil spill on the fine sand ecosystem are evaluated by means of macrofauna which represent medium hydrodynamic conditions. Different species were classified in ecological groups according to their sensitivity to hydrocarbons and to organic matter overload. The two parameters, specific richness and abundance per square meter, indicate the structure of the macrofauna population, while a third parameter, the biomass, can also be used. The study of these factors and their evolution in time, as well as the ecological groups, enables definition of the degradation, recolonization and restructuring conditions. Finally, predators such as fish juveniles, regulate these communities. Six years after the 'Amoco Cadiz' oil spill, even if this fine sand ecosystem reaches a new equilibrium, it is still too early for the regulation processes by predators to take place. (Lantz-PTT)
W86-05373

CHEMICAL FORMS OF ARSENIC IN MARINE ORGANISMS, WITH EMPHASIS ON HEMIFUSUS SPECIES,
Environmental Protection Agency, Kowloon (Hong Kong).
For primary bibliographic entry see Field 5B.
W86-05374

MOLECULAR AND CELLULAR INDICES OF POLLUTANT EFFECTS AND THEIR USE IN ENVIRONMENTAL IMPACT ASSESSMENT,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5A.
W86-05375

TRANSPORT AND WATER QUALITY MODELLING IN THE SOUTHERN NORTH SEA IN RELATION TO COASTAL POLLUTION RESEARCH AND CONTROL,
Waterloopkundig Lab. te Delft (Netherlands).
For primary bibliographic entry see Field 5B.
W86-05377

EFFECTS OF FERTILIZER, PIG MANURE, AND SEWAGE SLUDGE ON TIMOTHY AND SOILS,
Nova Scotia Agricultural Coll., Truro.
For primary bibliographic entry see Field 5E.
W86-05382

NATURE OF DICHLORVOS INTOXICATION IN A FRESHWATER PRAWN, MACROBRACHIUM LAMARREI (H. MILNE EDWARDS),
Gorakhpur Univ. (India). Dept. of Zoology.
O. Shukla, and G. S. Shukla.
Environmental Research, Vol. 37, No. 2, p 349-354, August 1985. 2 tab, 28 ref.

Descriptors: *Toxins, *Organophosphorous pesticides, Enzymes, Carbohydrates, Animal behavior, Prawns, Bioindicators.

Exposure of the freshwater prawn to a lethal dose (96-hr LCsub50: 0.78 mg/l) of dichlorvos for 24, 48, 72, and 96 hr. induced inhibition of avcetylcholinesterase (AChE) and alkaline phosphate activities and enhanced acidophosphatase activity. Hephatic glycogen values were depleted, whereas blood glucose level increased up to 72 hr of exposure. After 96 hr of dichlorvos exposure, hypoglycemia was observed. In general, the statistical significance of all physiologic effects increased with exposure time. It is inferred that dichlorvos exposure inhibits AChE activity and the accumulation of acetylcholine at the synaptic junctions, possibly leading to behavioral changes and creating a widespread disturbance of physiology, ultimately leading to the death of the animal. These dichlorvos-induced distrubances of physiology may be used as an index of environmental pollution by dichlorvos. (Rochester-PTT)
W86-05412

EFFECT OF AIRBORNE SULPHUR AND NITROGEN DEPOSITION ON AQUATIC AND TERRESTRIAL HEATHLAND VEGETATION,
Katholieke Univ. Nijmegen (Netherlands). Lab. of Aquatic Ecology.
For primary bibliographic entry see Field 5B.
W86-05416

5D. Waste Treatment Processes

SUMMER DISCOUNT METHODS IN SANITARY SEWER RATE STRUCTURES,
Lexington Dept. of Public Works, KY.
For primary bibliographic entry see Field 6C.
W86-04684

USED CHASSIS MAKES SEWER AND CATCH BASIN CLEANER AFFORDABLE,
T. P. Gilles, J. W. Konrad, and R. Westbrook.
Public Works, Vol. 117, No. 5, p 65-66, May 1986.

Descriptors: *Sewer systems, Ohio, Sewer cleaner, Catchment basin cleaner, Economic aspects, Drainage systems, Maintenance, Flooding, Maintenance costs.

Lake County, the smallest of Ohio's 88 counties, faces a multitude of problems resulting from the maintenance of drainage facilities. However, because of the county's size, budget dollars were not available for a combination sewer and catch basin cleaner, a machine that would be the ultimate solution to many of the sewer maintenance problems. The major problems included flooded catch basins, blocked sewer lines, and blocked driveway and roadway culverts. The Hydropower Sewer and Catch Basin Cleaner made by P. B. Loader Manufacturing Company, Fresno, CA fit on the used but still good chassis of a 1978 International Model 2010 truck. The chassis frame and driveshaft had to be extended, the suspension rebuilt, and some body work performed. P. B. Loader engineers supervised the preparation and mounting of the Hydropower unit onto the chassis. Total installation cost, including rebuilding the truck chassis and body work, came to $2,500. A combination sewer and catch basin cleaner was purchased for a total of $60,720, which was substantially less than the $100,000 originally projected for this type of equipment. In addition to using the high pressure system to clean sewers, the county has used it to clean other equipment, bridge bearings and seats, and, on occasion, to cool hot asphalt to allow traffic to return to normal after pavement repairs. (Peters-PTT)
W86-04685

SOLUTION TO RESIDENTIAL SEWER BACKUPS,
T. R. Adams, and G. Crane.
Public Works, Vol. 117, No. 5, p 70-71, May 1986. 2 fig.

Descriptors: *Sewer systems, *Precipitation, *Storm sewers, Separated sewers, Ohio, Sewer backups, Flow regulators, Flow rates, Storm runoff, Flooding, Drainage systems.

Since it was built in 1959, portions of the Colony Park residential development in Brunswick, Ohio suffered back-ups from the sanitary sewer system into basements during heavy rains. Because Colony Park was served by separate storm and sanitary sewers, it was believed to be immune from pressurized sanitary sewers and the possibility of sewage discharges into basements. The sewer systems were tested to find cross connections or places where leakage could exfiltrate from the storm system and flow quickly into the sanitary sewer. The city finally concluded that the problem was one of porosity at the house connections. In routine rain events, there was no appreciable leakage out of the house connections to the storm drains, but when flows were heavy enough to surcharge and pressurize the storm drains, then the house connections would pressurize as well. Then water would leak out of the storm drains and into the sanitary sewers, all via the house connections. The solution ultimately adopted was to install custom fitted, clog resistant flow regulators in each catch basin to regulate the flow rates from the catch basins into the storm drains. By careful sizing of the flow regulators, the catch basin discharges could be set to equal the capacity of the storm sewer pipes, thereby running the pipes at full capacity while protecting them against pressurization. The city built a short relief pipe designed to follow the lowest profile through the area to a suitable discharge point at a nearby stream. It would collect the runoff that could not enter the controlled catch basins, runoff that would continue flowing downhill in the curb and gutter until it reached the relief pipe. In the two and a half years since the stormwater management project was built, the city has received no complaints from Colony Park residents about either sewer back-ups or street flooding. (Peters-PTT)
W86-04686

USING THE FECAL COLIFORM TEST FOR SEWER AND STORM DRAIN MAINTENANCE,
Rogue Valley Council of Governments, Central Point, OR.
E. R. Dittmer.
Public Works, Vol. 117, No. 5, p 75, 98, 100, May 1986.

Descriptors: *Sewer systems, *Oregon, *Coliforms, *Storm drains, Storm Runoff, Bioassay, Medford, Bear Creek, Urban drainage, Bacterial analysis, Monitoring.

The Rogue Valley Council of Governments is working with Medford, Oregon to address the maintenance of sewer lines and storm drain pipes with the help of fecal coliform bacteria testing. Medford (population 40,000) like most urbanized areas, directs storm runoff via the storm drain system to local natural drainages rather than the wastewater treatment plant. Medford has an efficient and effective program for sewer and storm drain maintenance and recognized the potential value in expanding the use of the fecal coliform test for this purpose. The effort led to monitoring of other storm drain systems contributing to Bear Creek, which flows through downtown Medford. Detailed monitoring from the Bear Creek outfall progressively upstream along two major storm drain systems located a variety of coliform sources. These included a house with its sanitary lines plumbed to the storm drain lines, several leaking sewer lines saturating the ground with effluent entering the nearby storm drains, and an agricultural equipment wash rack plumbed to the storm rather than sanitary system. The cooperative effort worked efficiently in Medford. Significant sources of raw sewage entering the storm drain system have been located and fixed. The adverse impact of the storm drains has decreased and Bear Creek water quality has improved significantly. (Peters-PTT)
W86-04687

EVALUATING THE IN-VESSEL COMPOSTING OPTION, PART I,
Environmental Protection Agency, Washington, DC.
J. Walker, N. Goldstein, and B. Chen.
Biocycle BCYCDK, Vol. 27, No. 4, p 22-27, April 1986. 1 fig, 3 tab, 13 ref.

Descriptors: *Wastewater treatment, *In-vessel composting, *Evaluation, *Sludge disposal, Odor control, Pathogens, Bulking agents, Air management, Temperature, Curing, Municipal wastewater, Cost analysis, Public participation.

Guidelines are presented for determining how well an in-vessel composting system meets the needs and goals of a community seeking a sludge management solution. An evaluation approach was developed. Community goals for in-vessel sewage sludge composting operations that guided the development of this approach were as follows: odor-free operation, compost that is adequately dry, stable, pathogen free, and marketable, economical and reliable system, and public acceptability. Key areas for consideration in evaluating in-vessel composting that are discussed in this first of two articles are: citizen participation, sludge and bulking agent properties, mixing and porosity, air handling, air collection, air scrubbing and odor control, temperature and pathogen control, retention time, and curing. (Rochester-PTT)
W86-04716

DENVER'S DUAL UTILIZATION SLUDGE PROGRAM,
Black and Veatch, Aurora, CO.
For primary bibliographic entry see Field 5E.
W86-04717

SLUDGE MANAGEMENT ALTERNATIVES FOR SAN DIEGO,
Nolte (George S.) and Associates, Sacramento, CA.
For primary bibliographic entry see Field 5E.
W86-04718

DETERMINATION OF LINEAR ALKYLBENZENESULFONATES IN SEWAGE SLUDGE BY HIGH-RESOLUTION GAS CHROMATOGRAPHY/MASS SPECTROMETRY,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
For primary bibliographic entry see Field 5A.
W86-04721

SLUDGE ODOR CONTROL: IF AT FIRST YOU DON'T SUCCEED...,
D. Arey.
Public Works, Vol 117, No. 3, p 88, March 1986.

Descriptors: *Hydrogen sulfide, *Odor control, *Activated sludge, *Chlorination, *Cost analysis, Deodorant, Potassium permanganate, Calcium hypochlorite, Ozone, Carbon absorption, Microorganisms.

Attempts at odor control of hydrogen sulfide emanating from a secondary activated sludge plant with primary clarifiers are described. The first efforts were deodorizing and potassium permanganate spray; liquid live microorganisms and pH adjustment to keep sulfide in solution also were tried without success. After consideration of ozone and carbon absorption, chemical oxidation was chosen as the treatment method. Two types of oxidizing solution have been used: powdered calcium hypochlorite (65% solution) and liquid caustic (50% solution) or granular caustic, and a chlorine solution made with gaseous chlorine. The first oxidizing solution achieved 100% H2S removal, but cost 10.34 dollars/day to use. The second did not produce as high removal of H2S, but costs 20 cents per day for chemicals with operation and maintenance costs of 400 dollars annually. (Rochester-PTT)
W86-04736

BIG BUCKS SAVED ON SEWER REHABILITATION PROJECT,
For primary bibliographic entry see Field 8A.
W86-04740

METHOD FOR EVALUATION AND PROCUREMENT OF IN-VESSEL COMPOSTING SYSTEMS,
Schenectady City Dept. of Water Pollution Control, NY.
D. A. Conner, and J. A. Stearns.
Public Works, Vol. 117, No. 4, p 64-66, April 1986. 1 fig, 1 tab.

Descriptors: *Composting, *Evaluation, *Procurement, *Pilot plants, *Bidding process, *Waste treatment facilities, *Schenectady, New York, Modular design, Management planning.

In-vessel composting was evaluated as a replacement for a sludge incinerator in Schenectady, New York is discussed. The first step in the evaluation phase was on-site operation of a pilot test reactor. After successful completion of the tests, procurement was planned; four bidding alternatives were considered: sole source, bidding by functional specifications, multiple designs, and two-bid procurement. The two-bid procurement method was chosen; following the award of the first contract, which is for an evaluated piece of equipment, the remainder of the system was designed around the piece of equipment to be utilized. This system maintains control in the hands of the owner and provides an acceptable level of competition. Ultimately, an American Bio Tech system was chosen that featured a modular design with multiple independent composting units, an open architecture without enclosed areas, and a low-pressure aeration system. The presently designed system at Schenectady uses four full-size composting cells and a half cell for preconditioning the infeed material. The total composting volume will be 75,000 cu ft, which will provide over 29 days of detention time at average infeed conditions. (Rochester-PTT)
W86-04741

EFFECT OF NICKEL ON METHANE PRODUCTION AND BUTYRIC ACID UTILIZATION IN A DOWNFLOW FIXED-FILM REACTOR,
University Coll. of Swansea (Wales). Dept. of Chemical Engineering.
M. Canovas-Diaz, and J. A. Howell.
Biotechnology Letters BILED3, Vol. 8, No. 4, p 287-292, April, 1986. 6 fig, 14 ref.

Descriptors: *Wastewater treatment, *Nickel, *Butyric acid, *Whey, *Cheese factory waste, *Methane bacteria, *Downflow fixed-film reactor, Methanogenesis, Pilot plant, Wastewater facilities, Bacterial physiology.

Butyric acid conversion by a mixed methanogenic population in a pilot-scale anaerobic downflow fixed-film reactor (DFFR), treating a cheese factory effluent, was increased by the addition of nickel (30 mg/l NiCl2.6H2O). The butyric acid concentration dropped abruptly from 2,300 to 150 mg/l when the reactor was fed with Ni(II). When running two laboratory-scale DFFR's, butyric acid utilization and methane production were slightly higher within the reactor supplemented with nickel than in the reactor without nickel (control). Nickel appears to increase butyric acid utilization in a DFFR for whey and deproteinized cheese whey anaerobic digestion and slightly increases the reactor performance as reflected in higher methane production. (Rochester-PTT)
W86-04743

INFLUENCE OF DIFFERENT SUBSTRATE PH VALUES ON THE PERFORMANCE OF A DOWNFLOW ANAEROBIC FIXED BED REACTOR TREATING A PETROCHEMICAL EFFLUENT,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Microbiology.
L. H. Nel, and T. J. Britz.
Biotechnology Letters BILED3, Vol. 8, No. 4, p 293-298, April 1986.

Descriptors: *Wastewater treatment, *Hydrogen ion concentration, *Petrochemical effluent, *Methane bacteria, *Downflow anaerobic fixed bed reactor, *Sodium hydroxide, *Toxicity, Sodium ion, *Process control, Bases, Chemical oxygen demand, Cost analysis.

Neutralizing requirements for the anaerobic treatment of an acidic petrochemical effluent in a downflow anaerobic fixed-bed reactor were examined. Neutralization (pH 6.0 with NaOH) of the effluent prior to digestion resulted in a Na+ concentration of over 3 g/l, which produced a toxic effect, inhibiting the digestion process. Decreasing the Na+ concentration and subsequent replacement of NaOH by a mixture of Ca(OH)2, NaOH, and KOH resulted in an increase in reactor performance. The addition of different alkaline materials resulted in the best loading rates thus far applied in the anaerobic treatment of this effluent. During the final stages of this study, the effluent (pH 3.95) was with at a loading rate of 10.37 kg chemical oxygen demand/cu m per day (hydraulic retention time = 1.35 days), with more than 94% fatty acid removal. The methane yield at pH 3.95 was somewhat lower than at higher pH values, but this was insignificant compared to the rate increase in the processing. The economic implication of reducing the amount of alkali used for neutralizing is considerable. (Rochester-PTT)
W86-04744

KINETICS OF ANAEROBIC PURIFICATION OF INDUSTRIAL WASTEWATER,
Dow Chemical (Nederland) B.V., Terneuzen.
W. L. Bolle, J. van Breugel, G. C. van Eybergen, N. W. F. Kossen, and W. van Gils.
Biotechnology and Bioengineering BIBIAU, Vol. 28, No. 4, p 542-548, April 1986. 8 fig, 1 tab, 11 ref.

Descriptors: *Up-flow anaerobic sludge blanket reactor, *Growth rates, *Monod Model, *Andrews model, *Volatile fatty acids, *Bacterial physiology, *Kinetics, *Wastewater treatment, Mathematical models, Hydrogen ion concentration, Substrate inhibition, Statistics, Reactor failure.

As part of the development of an integral mathematical model describing the up-flow anaerobic sludge blanket reactor, the kinetics of the conversion of organic wastes has to be known. The Monod model was compared with one proposed by Andrews and others. Together with the assumption that this substrate for the anaerobic bacteria is formed by nonionized, volatile fatty acids, the Andrews model is able to describe substrate inhibition and reactor failure due to pH changes. From four batch experiments with different con-

centrations of microorganisms, it could be concluded with a reliability of over 95% that the Monod model was inadequate and the Andrews model was adequate to describe the measurements. Standard statistical techniques like Chi-square and F-tests were used. From a parameter sensitivity analysis for the Andrews model, it followed that the maximum specific growth rate (mu(A) sub max) of the bacteria and the inhibition constant K sub I are the parameters that influence the system most. These parameters were defined experimentally and most accurately, as follows: mu(A) sub max = 16 x 10(-4) per hr, + or - 2%, and K sub I = 0.0158 g unionized acetic acid/l + or - 2.5%. From a calculation of the Thiele modulus for the particles it follows that transport limitation of the substrate in the flocs is not significant. The efficiency is 0.85 in the worst case. (Author's abstract)
W86-04745

RECENT DEVELOPMENTS IN HYDROGEN MANAGEMENT DURING ANAEROBIC BIOLOGICAL WASTEWATER TREATMENT,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
S. R. Harper, and F. G. Pohland.
Biotechnology and Bioengineering BIBIAU, Vol. 28, No. 4, p 585-602, April 1986. 5 fig, 9 tab, 158 ref.

Descriptors: *Hydrogen, *Anaerobic digestion, *Energetics, *Methane bacteria, *Substrate specificities, *Single phase anaerobic filter, *Phase separated anaerobic filters, *Wastewater treatment, Phase-separated filters with gas cycling, Thermodynamics, Hydrogen acceptors, Kinetics, Bacterial physiology.

A comprehensive review of the microbial kinetics, energetics, and substrate specificities of anaerobic wastewater treatment systems includes descriptions of three state-of-the-art reactor configurations (single phase anaerobic filter, phase-separated anaerobic filters, and phase-separated filters with gas cycling). Topics reviewed are: the role of hydrogen in regulating acidogenesis, experimental and thermodynamic quantification of hydrogen effects, regulatory roles of hydrogen acceptors, the roles of hydrogen and acetate in regulating methanogenesis, and phase separation. Each of the three reactor systems is intended to enrich different populations of anaerobic acidogens and methanogens as a result of design and operational strategies for control of hydrogen and volatile acids. Imposition of these strategies result in different substrate utilization patterns, conversion kinetics, and operational stabilities as are currently being demonstrated in laboratory-scale investigations. (Rochester-PTT)
W86-04746

TIGHT MONEY HAMPERS CLEVELAND SEWER JOBS,
For primary bibliographic entry see Field 6C.
W86-04754

COPPER (2+), ZINC (2+), AND NICKEL (2+) UPTAKE BY ACTIVATED SLUDGE,
Universidad Complutense de Madrid (Spain). Dept. de Quimica Industrial.
A. Vian, F. J. Mirada, and J. J. Rodriguez.
Separation Science and Technology, Vol. 20, No. 7-8, p 587-597, September/October 1985. 1 fig, 5 tab, 28 ref.

Descriptors: *Activated sludge, *Adsorption, *Heavy metals, *Separation techniques, *Chemical precipitation, Copper, Zinc, Nickel, Fate of pollutants, Wastewater treatment, Biological wastewater treatment, Activated sludge process.

Removal of Cu, Zn, and Ni by activated sludge in a completely mixed unit occurs by uptake and by precipitation, the latter being particularly important in the cases of Cu and Zn. The amount of heavy metal taken up by the microorganisms at equilibrium varies with influent concentration for the three metals studied. The values obtained ranged from 2.3 mg/g VSS for Cu at 1 mg/liter in the influent to 57.4 mg/g VSS for Ni at influent 25 mg/liter. Soluble metal removal from wastewater increases in percentage with influent concentration, being higher for Cu and lower for Ni. Results of experiments carried out with mixtures of these metals show that the uptake values for Zn and Ni together are very similar to the individual figures of these metals at the same influent concentrations. A small reduction is observed for Zn and a small increase for Ni. When mixtures include Cu, the decrease in Zn uptake becomes more significant and there is a substantial increase in the amount of Ni taken up by the activated sludge. No important differences are observed for Cu between individual and mixture experiments at the same concentrations but when the Cu concentration in the mixture increases, there is a decrease of Zn and Ni uptakes. Higher metal removals occur when working with mixtures due to greater precipitation. Experiments with three-metal mixtures show an increase of relative precipitation and a decrease of uptake, which is more significant as the Cu concentration rises. (Geiger-PTT)
W86-04755

BACILLUS SUBTILIS/MICROSOME REC-ASSAY FOR THE DETECTION OF MUTAGENS IN WATERS OF A MUNICIPAL WASTEWATER TREATMENT PLANT,
Kanazawa Univ. (Japan). Dept. of Construction and Environmental Engineering.
For primary bibliographic entry see Field 5A.
W86-04782

FLOW MEASUREMENT AT SEWAGE TREATMENT PLANTS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 7B.
W86-04806

SULFUR OXIDES CONTROL TECHNOLOGY SERIES: FLUE GAS DESULFURIZATION; LIME/LIMESTONE PROCESSES,
Radian Corp., Austin, TX.
P. B. Hulman, and J. M. Burke.
Summary Report EPA 625/8-81-006, April 1981. 30 p, 6 fig, 9 tab, 33 ref.

Descriptors: *Sulfur, *Waste management, *Waste disposal, *Lime, *Limestone, Solid waste disposal, Land disposal, Waste dumps, Landfills, Wastes, Industrial wastes, Fly ash, Environmental effects.

The basics of the lime/limestone flue gas desulfurization processes are provided. The process is outlined in schematic form, including flue gas inflow, lime/limestone inflow, holding tanks, absorber system, recycle system, solids waste concentration, and cleaned flue gas removal. Design considerations, with emphasis on feed material processing, adsorption systems, scale control, mist elimination, solids dewatering and disposal, and fly ash chlorides are discussed. Environmental considerations and status of development are described. The major requirements for these systems, mainly raw materials (lime and limestone), electric power (pump, blowers and miscellaneous equipment), installation space, and land for solids disposal, are discussed. (Halterman - PTT)
W86-04819

REMEDIAL ACTION AT WASTE DISPOSAL SITES (REVISED): HANDBOOK.
Science Applications, Inc., McLean, VA.
EPA/625/6-85/006, October 1985. 645 p, 171 fig, 95 tab, 2 append. Contract No. 68-03-3113.

Descriptors: *Water pollution control, *Waste disposal sites, *Wastewater treatment, *Wastewater treatment facilities, *Wastewater disposal, *Waste disposal, *Remedies, Wastewater management, Waste management, Hazardous materials, Toxins, Air pollution, Landfills.

A handbook intended for use as a basic reference tool on remedial action at waste disposal sites is presented. An overview of the remedial investigation/feasibility study process, as outlined in the National Contingency Plan, is followed by a description of remedial technologies. The established technologies are described in terms of applications, limitations, design considerations, construction/implementation considerations, operation, maintenance, monitoring, technology selection/evaluation, and costs. Remedial action categories discussed include: surface water controls, air pollution controls, gas control, on-site and off-site disposal of wastes and soil, removal and containment of contaminated sediments, in-situ treatment, direct waste treatment, and contaminated water supplies and water and sewer lines. (Halterman - PTT)
W86-04820

ODOR AND CORROSION CONTROL IN SANITARY SEWERAGE SYSTEMS AND TREATMENT PLANTS,
Smith (J.M.) and Associates, Cincinnati, OH.
R. P. G. Bowker, and J. M. Smith.
EPA/625/1-85/018, October 1985. 132 p, 77 fig, 57 tab, 166 ref.

Descriptors: Descriptors; *Wastewater treatment, *Odor control, *Hydrogen sulfide, *Corrosion, *Corrosion control, Wastes, Sulfur, Sulfur Compounds, Wastewater, Wastewater facilities, Municipal wastewater, Industrial wastewater.

A major cause of odors in wastewater treatment systems is the toxicant hydrogen sulfide. This compound is also noted for its ability to corrode various materials used in sewer and treatment plant construction. A comprehensive design manual that brings together available information in a form for those designing new systems or applying odor and corrosion control procedures in existing systems is presented. Specific topics covered include: theory, prediction and measurement of odor and corrosion, odor and corrosion control in existing wastewater treatment plants, designing to avoid odor and corrosion in new wastewater collection systems, and designing to avoid odor and corrosion in new wastewater treatment facilities. (Halterman - PTT)
W86-04821

ELECTROPLATING INDUSTRY.
Centec Corp., Reston, VA.
Environmental Regulations and Technology Report EPA/625/10-85/001, September 1985. 44 p, 16 fig, 11 tab, 29 ref.

Descriptors: *Electroplating, *Wastes, *Industrial wastes, *Heavy metals, Wastewater, Industrial wastewater, Wastewater composition, Wastewater disposal, Wastewater management, Wastewater treatment.

A summary of the laws, regulatory activities, and technologies that affect decisions regarding wastewater treatment and solid waste handling and disposal, within the elctroplating industry, is provided. Specific areas covered include: water pollution control regulations, water pollution control technologies, water pollution control case histories, hazardous waste regulations and management, and pollution control financing alternatives. A list of Environmental Protection Agency sources of additional information is also provided. (Halterman - PTT)
W86-04823

USE AND DISPOSAL OF MUNICIPAL WASTEWATER SLUDGE,
Eastern Research Group, Inc., Arlington, MA.
J. Connery, E. Burke, and F. Lowenstein.
Environmental Regulations and Technology Report EPA 625/10-84-003, September 1984. 76 p, 31 fig, 17 tab, 45 ref.

Descriptors: *Sludge disposal, *Waste disposal, *Sludge combustion, Incineration, Waste treatment, Wastewater management, Waste management, Wastewater treatment, Land application, Land disposal, Ocean dumping.

When properly used, sludge can be a valuable resource as a soil conditioner partial fertilizer and as a source of methane for producing energy. This guidance document describes the five major sludge use/disposal options currently available -- land application, distribution and marketing of sludge

products, landfilling, incineration and ocean disposal. Factors influencing their selection and implementation are discussed. The initial framework for evaluating sludge use/disposal alternatives is provided. Accepted and proven technologies and Federal regulations pertinent to sludge management are described. The need to consult additional sources for more detailed information and design criteria, and for the most current information on emerging technologies is emphasized. (Halterman - PTT)
W86-04826

INFORMATIONAL/EDUCATIONAL APPROACHES TO PUBLIC ATTITUDES ON POTABLE REUSE OF WASTEWATER,
Denver Research Inst., CO.
L. C. Lohman, and J. G. Milliken.
Research Study Report and Program Guide for Municipal Water, System Administrators, August 1985. 128 p, 23 tab, 23 ref, 6 append.

Descriptors: *Water reuse, *Public opinion, *Public relations, Wastewater facilities, Water treatment facilities, Wastewter management, Wastewater renovation, Wastewater treatment.

A study is described in which the degree of public awareness about potable wastewater reuse was measured, and the effects of information/education measures on public understanding acceptance of potable wastewater reuse is analyzed. Results indicate that there is no identifiable subgroup in the population that can be targeted for an information/education program designed to achieve broad acceptance of potable water reuse. A prerequisite to positive change in attitude is citizen faith in the water supply agency. Reading material, supplemented by a plant tour, is necessary to achieve public interest and understanding of the reuse concept. Degree of public acceptance is closely related to understanding of potable reuse treatments. (Halterman - PTT)
W86-04827

SEPTAGE TREATMENT AND DISPOSAL: HANDBOOK,
Weston (Roy F.), Inc., West Chester, PA.
K. C. Wiswall, G. M. Johnson, L. Y. H. Lin, A. Dasgupta, and A. S. Eikum.
EPA-625/6-84-009, October 1984. 300 p, 79 fig, 59 tab, 221 ref, 1 append.

Descriptors: *Septic tanks, *Septic wastewater, *Wastewater, Domestic wastes, Wastewater disposal, Wastewater facilities, Wastewater management, Wastewater treatment, Land disposal.

An up-to-date review of available design, performance, operation and maintenance, cost and energy information pertaining to the receiving, treatment, and disposal of septage is presented. Information needed to facilitate the design of septage receiving stations, pretreatment processes, new sewage treatment plants with provisions for receiving septage, and independent septage treatment and disposal alternatives is provided. Methods for septage treatment and disposal discussed include land treatment and disposal, co-treatment at existing wastewater treatment facilities, and independent facilities for treatment and disposal. Individual treatment processes are discussed in detail and specific design guidance is provided. (Halterman - PTT)
W86-04828

ESTIMATING SLUDGE MANAGEMENT COSTS.
Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.
Handbook EPA/625/6-85/010, October 1985. 540 p, 138 fig, 18 tab, 7 ref, 3 append. Contract No. 68-03-3017 & 68-01-6621.

Descriptors: *Sludge disposal, *Economic aspects, *Sludge drying, Sludge digestion, Land disposal, Waste disposal, Waste treatment, Waste management, Wastewater management, Wastewater treatment.

Preliminary cost estimating curves, covering both capital costs and annual operating and maintenance costs, for commonly used processes in municipal wastewater sludge treatment, storage, transport, use or disposal, are provided. In addition, annual operating and maintenance curves, which provide additional user flexibility, are also included. The processes can be arranged into various sludge management chains and preliminary costs estimated for each sludge management chain to be evaluated. The cost curves provided generally cover a range up to 100 million gallons of sludge per year, equivalent to a wastewater treatment plant capacity of at least 50 mgd. An annotated bibliography of selected literature containing sludge management cost estimating information is included. (Halterman - PTT)
W86-04829

IMPROVING POTW PERFORMANCE USING THE COMPOSITE CORRECTION PROGRAM APPROACH: HANDBOODK,
Process Applications, Inc., Fort Collins, CO.
B. A. Hegg, J. R. Schultz, and K. L. Rakness.
EPA-625/6-84-008, October 1984. 258 p, 13 fig, 27 tab, 62 ref, 15 append.

Descriptors: *Publicly owned treatment works, *Wastewater treatment, *Wastewater, *Municipal wastewater, Performance evaluation, Sludge, Wastewater disposal, Wastewater facilities, Water treatment facilities.

Information on methods to economically improve the performance of existing publicly owned treatment works (POTWs) is presented. A variety of aspects of a recommended approach to conducting comprehensive performance evaluations are outlined. Data collection, evaluation of major unit processes, performance evaluation, evaluation of performance-limiting factors, and reports, are discussed. Details of conducting composite correlation programs are also presented. The initial site visit, improving design performance-limiting factors, improving maintenance limiting factors, improving administrative performance-limiting factors, and improving operational performance-limiting factors are detailed. (Halterman - PTT)
W86-04830

SULFUR OXIDES CONTROL TECHNOLOGY SERIES: FLUE GAS DESULFURIZATION; SPRAY DRYER PROCESSES,
Radian Corp., Austin, TX.
E. D. Gibson, M. A. Palazzolo, and M. E. Kelly.
Summary Report EPA 625/8-82-009, September 1982. 26 p, 4 fig, 6 tab, 20 ref.

Descriptors: *Flue gas desulfurization processes, *Waste management, *Sulfur, *Waste disposal, Spray dryers, Lime, Sodium carbonate, Solid waste disposal, Land disposal, Waste dumps, Landfills, Wastes, Industrial wastes, Fly ash, Environmental effects, Air pollution.

A basic description of the spray dryer flue gas desulfurization process is provided. Both sodium carbonate and lime spray drying are discussed, although lime is emphasized because of the higher reagent costs and waste disposal problems associated with sodium carbonate, and the greater commercial acceptance of lime for dry flue gas desulfurization. The process description, including absorbent preparation, absorption and drying, solids collection and solids disposal, is outlined. Design considerations such as selection and preparation of the absorbent, spray dryer design, spray dryer operation, and solids recycling are discussed. Environmental considerations are presented, and the major requirements of the system, such as raw materials, energy and installation space, are outlined. (Halterman - PTT)
W86-04831

FLUE GAS DESULFURIZATION INSPECTION AND PERFORMANCE EVALUATION: MANUAL.
PEI Associates, Inc., Cincinnati, OH.
EPA/625/1-85/019, October 1985. 295 p, 425 fig, 36 tab, 13 ref, 3 append.

Descriptors: *Waste management, *Sulfur, *Waste disposal, Soild waste disposal, Wastes, Air pollution, Industrial wastes, Fly ash, Environmental effects.

Information regarding various problems pertaining to lime/limestone slurry flue gas desulfurization systems is provided. The information is designed to aid inspectors, from federal and state environmental agencies, in their inspections and performance evaluations of these systems with respect to compliance with the emission standards that have evolved since the passage the 1970 Clean Air Act. Lime and limestone flue gas desulfurization technology is reviewed; performance monitoring techniques for all key operating parameters are outlines; inspection methods and procedures are detailed; and performance evaluation and problem diagnosis/correction techniques are discussed. A model operations and maintenance plan is presented as an example of an ideal system. (Halterman - PTT)
W86-04832

OPERATION AND MAINTENANCE MANUAL FOR ELECTROSTATIC PRECIPITATORS,
Environmental Protection Agency, Research Triangle Park, NC. Office of Research and Development.
G. L. Saunders, R. L. Hawks, and M. F. Szabo.
Manual EPA/625/1-85/017, September 1985. 480 p, 93 fig, 17 tab, 32 ref, 5 append. Contract No. 68-02-3919.

Descriptors: *Waste management, *Sulfur, *Waste disposal, *Electrostatic precipitators, Solid waste disposal, Wastes, Air pollution, Industrial wastes, Fly ash, Environmental effects, Operation manual.

All aspects of the operation and maintenance of electrostatic precipitators are presented. The basic theories and principles of electrostatic precipitation are outlined. Performance monitoring as a major element in an operation and maintenance program are discussed. Performance monitoring and other data is the evaluation of control system performance, in the discovery of real or impending problems, and in the diagnosis and correction of causes of poor performance are described. Guidelines for general operation and maintenance, and procedures that can be used to improve and sustain control equipment performance and reliability are presented. Methods and procedures for the detailed inspection of electrostatic precipitator systems and their components are detailed. Finally, the more important elements of an adequate operation and maintenance program are summarized. (Halterman - PTT)
W86-04833

MUNICIPAL WASTEWATER SLUDGE COMBUSTION TECHNOLOGY.
Environmental Protection Agency, Cincinnati, OH. Center for Environmental Research Information.
Seminar Publication EPA/625/4-85/015, September 1985. 177 p.

Descriptors: *Sludge disposal, *Sludge combustion, *Waste disposal, *Municipal wastewater, Incineration, Waste treatment, Waste management, Wastewater management, Wastewater treatment, Wastewater, Septic sludge.

Various municipal sludge combustion systems are described and evaluated. The necessity for considering and evaluating the costs involved in the total sludge management train, including dewatering, combustion, air pollution control, and ash disposal processes are emphasized. Questions that have been raised about incineration as a means of processing sludge solids for ultimate disposal are answered. The primary objectives of the material presented are to assess the current status of municipal sludge combustion technology as to performance of in-place systems, environmental concerns, and regulatory agency viewpoints; to increase economy of sludge combustion; and to discuss current technology. (See W86-04836 thru W86-04839) (Halterman - PTT)
W86-04835

SLUDGE INCINERATION FACILITIES,

D. C. Bergstedt, R. I. Dick, K. S. Feindler, S. Kyosai, and C. H. Nels.
IN: Municipal Wastewater Sludge Combustion Technology, Seminar Publication EPA/625/4-85/015, September 1985. p 1-28, 6 fig, 10 tab.

Descriptors: *Sludge disposal, *Sludge combustion, *Waste disposal, Incineration, Waste treatment, Waste management, Wastewater management, Wastewater treatment, Japan, Europe, Federal Republic of Germany, Fluidized beds furnace, Multiple-Hearth furnace, Electric furnace.

Recent developments in more efficient solids dewatering processes and advances in combustion technology have renewed interest in the use of high temperature processes for specific applications. These processes are recommended where available land is scarce, stringent requirements for land disposal exist, destruction of toxic materials is required, or potential exists for recovery of energy, either with wastewater solids alone or combined with municipal refuse. The structure and function of major furnace types, including multiple-hearth, fluidized-bed, and electric are described. Statistics on wastewater sludge incineration in the United States, Europe, the Federal Republic of Germany and Japan are presented. (See also W86-04835) (Halterman - PTT)
W86-04836

IMPROVING SLUDGE INCINERATION METHODS,
Zimpro, Inc., Rothschild, WI.
R. G. Forbes, P. F. Gilbert, R. T. Haug, S. Kyosai, and F. M. Lewis.
IN: Municipal Wastewater Sludge Combustion Technology, Seminar Publication EPA/625/4-85/015, September 1985. p 29-64, 9 fig, 4 tab.

Descriptors: *Sludge disposal, *Sludge combustion, *Waste disposal, *Incineration, Waste treatment, Waste management, Wastewater management, Wastewater treatment, Dewatering, Furnaces.

Case studies are used to discuss how several operational problems were overcome at existing wastewater sludge incineration facilities. Specific topics discussed include the rate and properties of feed, combustion processes, furnace operation, multiple-hearth furnaces, moisture evaporation rate, combustion control logic, dewatering sludge, fuel needs, upgrading existing furnaces to reduce fuel needs, autogenous combustion, superautogenous combustion, and waste heat recovery equipment. (See also W86-04835) (Halterman - PTT)
W86-04837

COCOMBUSTION OF SLUDGE AND SOLID WASTES,
Carlson Associaters Technical Services, Redwood City, CA.
E. G. Carlson, A. Baturay, D. C. Bergstedt, W. F. Cosulich, and K. S. Feindler.
IN: Municipal Wastewater Sludge Combustion Technology, Seminar Publication EPA/625/4-85/015, September 1985. p 65-100, 3 fig, 10 tab.

Descriptors: *Sludge disposal, *Sludge combustion, *Waste disposal, *Incineration, *Cocombustion, Waste treatment, Waste management, Wastewater management, Wastewater treatment, Solid wastes, Solid waste disposal.

Various aspects of cocombustion of sludge and solid wastes are discussed. The rationale for considering the joint combustion of sludge and solid wastes is that sludge, even after dewatering by conventional methods, lacks sufficient heat value to balance the evaporative burden of its remaining moisture when it is burned in a typical combustor. Types of burners suitable for codisposal and predrying of sludge solids are evaluated. Case histories of coincineration practices are presented for systems in Stamford, CT; Glen Cove, NY; Duluth, MN; and Flint River, GA. Types of codisposal systems in the United States and Europe are reviewed, and statistics on specific sites are listed. (See also W86-04835) (Halterman - PTT)
W86-04838

EMERGING TECHNOLOGY,
Environmental Protection Agency, Washington, DC. Office of the Assistant Administrator for Water.
R. K. Bastian, C. Spooner, D. C. Chase, and H. T. Chase.
IN: Municipal Wastewater Sludge Combustion Technology, Seminar Publication EPA/625/4-85/015, September 1985. p 134-177, 17 fig, 7 tab.

Descriptors: *Sludge disposal, *Sludge combustion, *Waste disposal, *Incineration, Waste treatment, Waste management, Wastewater management, Wastewater treatment, Solid waste disposal, Liquification, Gasification.

Processes for thermal conversion of municipal sludge are discussed. Gasification, liquification, wet oxidation and combustion are emphasized. Specific topics covered include operating parameters, development status, fuel ash content, air pollution emissions, conversion of sludge solids to fuel oil, conversion of sludge to oil by hydroliquefaction, energy considerations, starved-air combustion, and pyrolysis. Case studies in the United States, Germany, and Japan are presented. (See also W86-04835) (Halterman - PTT)
W86-04839

PROCESS DESIGN MANUAL FOR LAND TREATMENT OF MUNICIPAL WASTEWATER: SUPPLEMENT ON RAPID INFILTRATION AND OVERLAND FLOW.
Environmental Protection Agency, Cincinnati, OH. Office of Water Program Operations.
Report EPA 625/1-81-013a, October 1984. 121 p.

Descriptors: *Land disposal, *Overland flow, *Infiltration, *Soil disposal fields, *Waste disposal, *Municipal wastewater, Wastewater disposal, Wastewater treatment, Wastewater management, Wastewater.

A supplement to the 1981 Technology Transfer Process Design Manual for Land Treatment of Municipal Wastewater is presented. The design of rapid infiltration systems is described, and guidance and detail on planning, design, construction, and operation is provided. The information is provided to avoid problems which have been observed in recently constructed systems. Detailed information pertaining to overland flow is also provided. Design criteria, preapplication treatment, storage, distribution systems, terrace design and construction, as well as vegetation selection and establishment, are discussed. (See W86-04841 thru W86-04842) (Halterman - PTT)
W86-04840

RAPID INFILTRATION,
Cold Regions Research and Engineering Lab., Hanover, NH.
S. C. Reed, A. T. Wallace, H. Bouwer, C. Enfield, and C. Stein.
IN: Process Design Manual for Land Treatment of Municipal Wastewater: Supplement on Rapid Infiltration and Overland Flow. Report EPA 625/1-81-013a, October 1984. p 1-66, 6 fig, 7 tab, 71 ref.

Descriptors: *Land disposal *Waste disposal, *Rapid infiltration, *Percolation, Soil disposal fields, Wastewater disposal, Municipal wastewater, Wastewater treatment, Wastewater management, Groundwater, Wastewater.

Rapid infiltration (RI) is a very successful and cost-effective method for wastewater management. RI systems can be designed for wastewater treatment; or as one component in a waste re-use plan involving recovery of the treated water and/or storage in an aquifer. The concept depends on a relatively high rate of wastewater infiltration into the soil followed by rapid percolation, either vertically or laterally, away from the application point. The best soils are relatively coarse textured, with moderate to rapid permeabilities. In practice, wastewater application rates have ranged from about 15 m/yr to 120 m/yr (50-400 ft/yr) for successful RI systems. This supplement provides additional guidance, than in the Manual, and where necessary, a stronger emphasis and more specific detail on critical aspects so that problems can be avoided in future design. In addition, this supplement presents information developed since 1981 on performance of RI systems with respect to nitrogen removal, organics removal, and the need for disinfection. (See also W86-04840) (Lantz - PTT)
W86-04841

OVERLAND FLOW,
ERM-Southeast, Inc., Brentwood, TN.
D. D. Deemer, R. E. Thomas, S. C. Reed, J. L. Witherow, and G. Morgan.
IN: Process Design Manual for Land Treatment of Municipal Wastewater: Supplement on Rapid Infiltration and Overland Flow. Report EPA 625/1-81-013a, October 1984. p 67-121, 6 fig, 4 tab, 63 ref.

Descriptors: *Overland flow, *Land disposal, *Soil disposal fields, *Waste disposal, *Municipal wastewater, Wastewater disposal, Wastewater, Wastewater treatment, Wastewater management.

When the 2nd edition of the Technology Transfer Process Design Manual for Land Treatment of Municipal Wastewater was published, the overland flow (OF) process was just beginning to gain recognition as an effective wastewater treatment alternative. The experience gained and successes reported from these early OF projects have led to a substantial increase in the use of the OF process for smaller communities. As of March 1984, there were approximately 48 municipal OF systems in operation or in some stage of design or construction. Although not intended to replace the Manual, this section aims to update and refine the information contained in the Manual with the more recent experiences gained during design, construction, and operation of an increasing number of municipal OF systems. The information provided here, is based principally on two sources of information: (1) field investigations of six OF systems which were placed into operation in 1983 and 1984, ranging in size from 265 to 11,356 cu m/d (0.07 to 3.0 MGD) and three systems which were under construction in early 1984; and (2) recently available data from research/demonstration projects. Although it is premature to assess adequately the effectiveness of the municipal OF facilities, it appears that most of them will be capable of meeting their discharge criteria. The field investigations also uncovered a number of design, construction, and operational factors which could be modified to improve their performance and reliability. These factors are organized by subject matter in this text. (See also W86-04840) (Lantz - PTT)
W86-04842

TREATMENT OF A PETROCHEMICAL WASTEWATER IN SEQUENCING BATCH REACTOR,
Shell Development Co., Houston, TX.
E. H. Hsu.
Environmental Progress, Vol. 5, No. 2, p 71-81, May 1986. 4 tab, 20 fig, 19 ref.

Descriptors: *Wastewater treatment, *Oil industry, *Biological oxygen demand, Sequencing batch reactors, Nitrification, Organic shock, Effluents, Phenols, Monod kinetics, Activated sludge process, Solids, Model studies, Mathematical models.

The performance of sequenching batch reactors (SBR) in an industrial application was investigated by using wastewater from a petrochemical complex. Four bench-scale SBR's and a bench-scale conventional activated sludge unit were operated. In terms of the degradation of BOD material and nitrification, the performance of the SBR's was comparable or slightly superior to that of the conventional activated sludge unit. However, for high strength wastes with BOD's $>$ 300 mg/l under organic loading conditions, effluent from an SBR may have a high solids content as a result of abundant dispersed-cells growth. The SBR reacted well to a series of phenolic shock loadings; phenols were degraded from initial concentrations ranging from 200 to 950 mg/l to $<$0.1 mg/l. The present SBR model was adequate in predicting reactor performance in terms of MLVSS and the effluent BOD's concentration. The model should be useful as a design tool for SBR's. (Peters-PTT)

W86-04945

ECONOMICS OF MEMBRANE TREATMENT OF WASTEWATERS CONTAINING FIRE-FIGHTING FOAM,
Civil Engineering Lab. (Navy), Port Hueneme, CA.
D. B. Chan, and E. S. K. Chian.
Environmental Progress, Vol. 5, No. 2, p 104-109, May 1986. 6 tab, 1 fig.

Descriptors: *Wastewater treatment, *Ultrafiltration, *Reverse osmosis, Membrane processes, Aqueous film forming foam, Oil, Gasoline, Cost analysis, Economic evaluation.

Aqueous Film Forming Foam (AFFF) is the most effective fuel/oil firefighting agent. Wastewater generated from firefighting training facilities contains mixtures of AFFF, residual free fuel oil, emulsified fuel oil, gasoline, purple K (PKP), and miscellaneous combustion products. Membrane treatment of these wastewaters by a two stage ultrafiltration (UF) and reverse osmosis (RO) process appears economically attractive. A design of a 10,000 gallon/day (g pd) UF and RO recovery system was prepared for testing at a Navy application site. The total cost of the system including a membrane cleaning module that costs $15,000 and a 10% total cost used as contingency fee is estimated at $220,000. Cost effectiveness of the membrane process is compared with a rotating biological contactor and a carbon adsorption system. A firefighting facility using the UF and RO system can realize net savings if the following conditions at the facility are met: (1) more than 300 gallons of AFFF a day are used and the facility operates 250 days a year; (2) it uses recovered AFF and water; and (3) it generates 10,000 gpd or more AFFF-laden wastewater, and contains 3 percent or more AFFF in the waste. Application of this treatment technology will not only meet pollutions abatement objective, but also will meet Resource Conservation and Recovery Act (RCRA) requirements. (Peters-PTT)
W86-04947

BIOTREATED COAL LIQUEFACTION WASTEWATER: IDENTIFICATION OF ORGANICS BY COMPOSITE RO MEMBRANE CONCENTRATION, HPLC, AND GC/MS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
M. M. Jevtitch, and D. Bhattacharyya.
Environmental Progress, Vol. 5, No. 2, p 130-134, May 1986. 5 tab, 7 fig, 10 ref.

Descriptors: *Coal, *Reverse osmosis, *Biological wastewater treatment, Phenols, Cresol, Resorcinol, Wastewater treatment, Total organic carbon, Biological oxygen demand, Ash, Suspended solids, Silicon, Calcium, Magnesium, Iron, Sulfur, Sodium, Copper, Zinc, Cadmium, Lead, Nickel, Permeate.

A combination of aromatic polyamide RO membrane, HPLC and GC/MS was used to characterize feed and permeate samples from a coal liquefaction wastewater. The residual organics after biological treatment and their rejections by thin film membranes were identified and tested. Various derivatives of lactams and nitrobenzene esters were detected as by-products of the biooxidation process. Molecules of mass >155 were not detected in the permeate. At 90% water recovery, the membrane showed 91% chloride removal and 94% total organics removal. Similar results were obtained by HPLC analysis by comparing peak ratio reduction between feed and permeate. The membrane process provides an efficient treatment which makes the permeate suitable for recycling even under high water recovery conditions. (Peters-PTT)
W86-04949

ANAEROBIC BIODEGRADATION OF A RECALCITRANT DETERGENT WASTEWATER,
Malaya Univ., Kuala Lumpur (Malaysia). Dept. of Genetics and Cellular Biology.
C. Punchiraman, and R. S. Hassan.
Effluent and Water Treatment Journal, Vol. 26, No. 3/4, p 85-88, March/April 1986. 11 fig, 32 ref.

Descriptors: *Detergents, *Wastewater treatment, *Anaerobic digestion, Anaerobic biodegradation, Alkylbenzene sulphonates, Biodegradation, Organic compounds, Toxicity, Sludge.

The effect of branched chain alkylbenzene sulphonates (ABS) on the anaerobic digestion process was studied as was its possible degradation under anaerobic conditions. There was a direct response between concentration of ABS applied and the inhibition of growth of the bacteria from 1000 to 5000 mg/L of ABS. At low ABS concentrations of <1000 mg/L no inhibition zones were detected. The addition of detergent wastewater generally impairs the proper functioning of the anaerobic digesters compared to the sludge-fed digesters. The deleterious effect could be directly due to the toxic effect of the chemicals in the detergent formulation. The ratio of the admixtures is important; 50% sludge-detergent mixtures is ideal for the process. The addition of pure detergent wastewater seriously affected the anaerobic digestion process due to toxicities, excessive washout and lack of replenishment of nutrients and bacteria. The anaerobic digestion process does not seem to degrade the recalcitrant detergent molecules. (Peters-PTT)
W86-04952

ANAEROBIC FILTRATION OF A DISTILLERY WASTE,
Roorkee Univ. (India). Dept. of Civil Engineering.
R. P. Mathur, R. Bhargava, and A. Gupta.
Effluent and Water Treatment Journal, Vol. 26, No. 3/4, p 89-91, March/April 1986. 3 tab, 6 fig, 10 ref.

Descriptors: *Anaerobic digestion, *Wastewater treatment, *Filtration, *Food-processing wastes, Biogas, Biological oxygen demand, Chemical oxygen demand, Volatile acids, Nitrogen, Solids, Dissolved solids, Organic loading, Methane.

Molasses based distillery wastes were used to study the efficacy of anaerobic filtration. The upflow anaerobic filter is capable of reducing organic matter with an efficiency of 80% removal at an organic loading of 3.7 kg/cm m/day. At the maximum removal the average COD stabilization was 12 to 15 gms/day. At lower loadings buffering is not necessary. The system had the ammonia available to buffer the system even at higher organic loading but the detention time was too short to effect it. The average production of biogas was 2.0, 3.6, and 3.9 L/day at three organic loadings of 3.7, 5.6, and 7.4 kg/cu m/day but the methane content was more at low loadings. (Peters-PTT)
W86-04953

FILTRATE AND CAKE QUALITY IN SLUDGE DEWATERING,
Nigeria Univ., Nsukka. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W86-04954

RECYCLING -- KEY TO ONE STEEL MILL'S POLLUTION CONTROL,
Sverdrup and Parcel and Associates, Inc., St. Louis, MO.
J. Peltier, D. F. Cairns, and J. C. Buzzell, Jr.
Effluent and Water Treatment Journal, Vol 26, No. 3/4, p 127-131, March/April 1986. 2 tab, 2 fig, 1 ref.

Descriptors: *Recycling, *Industrial wastewater, Horseshoe Lake, Blowdown treatment plant, Chlorination, Filtration, Mississippi River, Sulphonation, Stabilization lagoons, Steel, Wastewater treatment, Recreation, Solids.

At the Granite City steel division of National Steel Corporation, a medium sized, integrated facility producing flat rolled steel products, located in Madison County, Illinois, a step in water pollution control was completed by placing a wastewater recycling system into operation to meet both immediate and long term water pollution control goals. Wastewaters originate from the following major production facilities: by product coke plant; two blast furnaces; sintering plant; basic oxygen furnace shop; blooming mill; 80-inch hot strip mill; 72-inch hot rolled coil processing and slitting lines; continuous coil picking line; 56-inch four-stand, cold strip reducing mill; three continuous galvanizing lines; batch pickling unit; and steam generating facilities. The new facilities include a recycle pump station, new pipelines, the blowdown treatment plant, and an outfall channel. The treatment sequence in the blowdown plant includes breakpoint chlorination, filtration and sulfonation. This recycling approach permits Granite City Steel to continue to supply Horseshoe Lake with water of high quality to support a year round recreational base in a State Park and prevent the threat of the lake's becoming dry due to inadequate water supply. Recycling from the stabilization basins provides the mill with a water source containing lower solids content than that withdrawn from the Mississippi River. (Peters-PTT)
W86-04956

LIFT STATION DESIGN,
GRW Engineers, Lexington, KY.
For primary bibliographic entry see Field 8A.
W86-04959

PHOTODEGRADATION OF THE HERBICIDE GLYPHOSATE IN WATER,
Norwegian Plant Protection Inst., Aas.
K. Lund-Hoie, and H. O. Friestad.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 36, No. 5, p 723-729, May 1986. 1 tab, 4 fig, 10 ref.

Descriptors: *Herbicides, *Aquatic environment, *Ultraviolet radiation, Glyphosate, Photodegradation, Lakes, Clay loam.

The effect of artificial light as well as sunlight on glyphosate (Roundup R) in water of varying qualities is reported. Solutions of 1 ppm of glyphosate in deionized water were exposed indoors to the following light qualities: sodium light with energy maximum peaks between 550 nm and 650 nm; mercury light with energy maximum between 400 and 600 nm; and UV-light with energy maximum at 254 nm. Glyphosate (2000 ppm) was dissolved in deionized water and continuously exposed to darkness or UV-light at 254 nm. In an outdoor experiment, different water qualities with 1 percent glyphosate added were exposed to sunlight. The water samples included were: deionized water, deionized water plus silty clay loam; polluted water from an inland lake; polluted water plus 5 percent silty clay loam. Long-wave light did not have any photodegrading effect on glyphosate. UV-light was about 4 days. The rapid photodegradation in pure water was also seen in the outdoor experiment. The degradation of glyphosate in deionized water was faster than in polluted water; the disappearance was influenced by the presence of clay. The content of glyphosate adsorbed to clay derived from deionized and polluted water was 12 ppm and 10 ppm, respectively. The results show that UV-light possesses a high capacity for degrading glyphosate. The rate of degradation proceeds faster in pure water than in polluted water. (Peters-PTT)
W86-04961

OMAHA MOVES FROM 'DISPOSE ALL' TO MANAGEMENT,
Omaha Public Works Dept., NE. Quality Control Div.
For primary bibliographic entry see Field 5E.
W86-04974

UPGRADING WITH SPRAY IRRIGATION,
Tatman and Lee Associates, Wilmington, DE.
For primary bibliographic entry see Field 5E.
W86-04975

RAPID DETERMINATION OF CHEMICAL OXYGEN DEMAND IN WASTE WATERS AND EFFLUENTS BY FLOW INJECTION ANALYSIS,

Loughborough Univ. of Technology (England). Dept. of Chemistry.
For primary bibliographic entry see Field 5G.
W86-04992

PLATE SEPARATION - BUDDING CONVENTIONAL TECHNOLOGY,
Aqua Trend, Inc., Shawnee Mission, KS.
C. G. Steiner.
Water Engineering and Management, Vol. 133, No. 3, p 32-34, 22. 10 fig.

Descriptors: *Gravity separation, *Plate separation, *Oil, *Grease, *Scum, *Waxes, *Neutral-gravity particles, *Wastewater facilities, Water conservation.

The general theory dealing with differential gravity separation is explained, and characteristics of various devices employing these principles are described. These include: simple rectangular clarifier, clarifer with parallel plates, down flow separator, cross flow separator, up flow separator, inclined plate separator, corrugated plate separator, combination flocculator separator, dissolved air flotation (DAF) separator, and combination separator DAF separator. Variants of gravity separators built around stacks of parallel plates offer a number of distinct performance advantages for separating such contaminants as oil, scum, fats, greases, waxes, and neutral gravity particles from water. Separators may be used to separate two types of particles. Such particle classification can save significant quantities of transport, dilution, or elutriation water if done in a dynamic rather than static mode. The technology of plate separation is now better understood than previously; designs offer several treatment options and unlimited flow capabilities in either shop-built packaged steel or site-constructed concrete materials for construction. (Rochester-PTT)
W86-05011

PRETREATMENT BY THE METAL FINISHING INDUSTRY,
Lancy International, Inc., Zelienope, PA.
F. A. Steward.
Water Engineering and Management, Vol 133, No. 3, p 35-36, March 1986. 2 fig.

Descriptors: *Pretreatment of water, *Metal-finishing wastes, *Cyanides, *Chromium, *Municipal wastewater, Surface runoff, Process control, Caustic soda, Lime, Atmospheric particulates, Metal salts, Precipitates, Hydrogen ion concentration.

Waste pretreatment in the metal finishing industry is as an aid to municipal wastewater treatment plant operators who must treat the waste from these businesses. The satisfactory performance of a treatment program for this industry depends on several factors: proper segregation of waste streams containing cyanides or hexavalent chromium; control of reaction pH, chemical additions and reaction time; chemical additions made by ORP controllers in both the cyanide and hexavalent chromium processes; neutralization using caustic soda and chemical treatments for cyanide and chromium are complete within 5 min (20 minute retention time when lime slurry is used); cleanliness of the probes used on pH and ORP controllers; avoidance of problems due to chelating compounds in the waste stream; and adequate physical separation of the precipitated metal salts. Metallic contaminants may also originate from street runoff, wash out of atmospheric particulates, and other sources besides metal finishing plants. (Rochester-PTT)
W86-05012

FIELD EVALUATION OF ARSENIC AND SELENIUM REMOVAL BY IRON COPRECIPITATION,
Brown and Caldwell, Pleasant Hill, CA.
D. T. Merrill, M. A. Manzione, J. J. Peterson, D. S. Parker, and W. Chow.
Journal of the Water Pollution Control Federation, Vol. 58, No. 1, p 18-26, January 1986. 11 fig, 1 tab, 18 ref.

Descriptors: *Arsenic, *Selenium, *Sludge, *Iron coprecipitation, *Pilot plants, *Ash pond effluents, *Wastewater facilities, *Wastewater treatment, Cost analysis, South Carolina, Feasibility studies.

To demonstrate iron coprecipitation technology, a field study was conducted at the Carolina Power and Light Company's Roxboro Power Station. The objectives of the study were to verify previously derived laboratory results, confirm technical and economic feasibility, and develop design and cost information for full-scale treatment plants that remove arsenic and selenium from ash-pond effluents. Basic chemistry, pilot plant, liquid treatment results, sludge production, sludge thickening, sludge dewatering, hazardous waste analysis, and costs are discussed. Arsenate removal exceeded 90% at clarifier overflow rates up to 49 cu m/sq m per day as long as iron doses were 14 mg/liter and above. Selenium removal (56-89%) was limited by the fraction of selenate in the waste stream. Arsenic and selenium adsorption was rapid and was completed within 2 min of chemical addition. Wastewater solids and chemical precipitates were effectively coagulated and settled over wide ranges of pH, iron dose, and polymer dose. Process sludges can be concentrated first with gravity thickeners and then with filter presses. Sludges from treatment of Roxboro plant ash pond effluent were not hazardous as defined by the extraction-procedure toxicity test. Total process costs are estimated at 9.3 cents per cu m of wastewater treatment. Coprecipitation with iron is technically and economically feasible for arsenic removal and for selenium removal as well if selenium is predominantly selenite. (Rochester-PTT)
W86-05015

COMPARATIVE REMOVAL OF TOXIC POLLUTANTS BY SIX WASTEWATER TREATMENT PROCESSES,
Environmental Protection Agency, Cincinnati, OH.
S. A. Hannah, B. M. Austern, A. E. Eralp, and R. H. Wise.
Journal of the Water Pollution Control Federation, Vol. 58, No. 1, p 27-34, January 1986. 14 tab, 9 ref.

Descriptors: *Toxins, *Priority pollutants, *Activated sludge, *Trickling filters, *Filtration, *Aerated lagoons, *Facultative lagoons, *Organic matter, *Wastewater treatment, Pilot plants, Wastewater facilities.

The capabilities of five less-than-secondary treatment processes (high-rate trickling filter system, primary treatment with chemical addition, direct filtration of primary effluent, aerated lagoon, and facultative lagoon) were evaluated for removal of priority pollutants and partition and interaction of organics within the systems were determined. A conventional activated sludge system was operated in parallel to provide a control for comparison of the alternative processes. The control activated sludge process provided the best removals of both conventional pollutants and toxic priority pollutants. The facultative lagoon with its long detention time was the most successful alternative process. The aerated lagoon with a shorter detention time was less effective than the facultative lagoon. The high-rate trickling filter system was less effective than the lagoons. The chemical clarification system and the primary plus filtration system removed only those toxics associated with wastewater solids. These two systems would not be good choices for removal of toxic priority pollutants. Selected alternative processes may be acceptable in site-specific situations, where toxic removal requirements are limited because of consistently low influent concentrations of toxic chemicals and where water quality criteria are not overly restrictive. (Rochester-PTT)
W86-05016

ADSORPTION, DESORPTION, AND BIOREGENERATION IN AN ANAEROBIC, GRANULAR ACTIVATED CARBON REACTOR FOR THE REMOVAL OF PHENOL,
General Motors Research Labs., Warren, MI.
B. R. Kim, E. S. K. Chian, W. H. Cross, and S. S. Cheng.
Journal of the Water Pollution Control Federation, Vol. 58, No. 1, p 35-40, January 1986. 7 fig, 1 tab, 16 ref.

Descriptors: *Adsorption, *Desorption, *Bioregeneration, *Activated carbon, *Phenol, *Biogas, *Wastewater treatment, Biomass production, Pilot plants, Wastewater facilities, Biodegradation.

The relative contributions of adsorption, biodegradation (biogas production), and biomass production were studied along with bioregeneration in the removal of phenol in an anaerobic, fluidized granular activated carbon (GAC) reactor. Two two-stage pilot-scale anaerobic GAC reactor units were used. The results, obtained from running a GAC reactor for approximately 200 days (starting with fresh GAC), indicated that contributions of biogas production, adsorption, and biomass production were all important in the removal of phenol. Biogas production was most important, whereas the contributions of adsorption and biomass accumulation to total carbon retained in the reactor were comparable. Bioregeneration occurred as adsorbed phenol was desorbed because of reduced influent phenol concentration. This also was shown by increased biogas production during the same period. (Rochester-PTT)
W86-05017

DESIGN AND PERFORMANCE OF A GROUNDWATER TREATMENT SYSTEM FOR TOXIC ORGANIC REMOVAL,
CH2M Hill, Inc., Gainesville, FL. Hazardous Waste and Industrial Processes Div.
For primary bibliographic entry see Field 5G.
W86-05018

ENERGY USAGE OF ROTATING BIOLOGICAL CONTACTOR FACILITIES,
Environmental Protection Agency, Washington, DC. Office of Municipal Pollution Control.
W. G. Gilbert, J. F. Wheeler, and A. MacGregor.
Journal of the Water Pollution Control Federation, Vol. 58, No. 1, p 47-51, January 1986. 7 tab, 9 ref.
EPA Contract No. 68-01-6622.

Descriptors: *Rotating biological contactor, *Biological wastewater treatment, *Energy use, *Energy conservation, *Electric power demand, *Wastewater treatment, Design considerations, Biofilm, Process control, Wastewater facilities, On-site tests.

A field survey was conducted of energy requirements of 29 rotating biological contactor facilities (RBC: 22 mechanical drive, 7 air drive), which were selected to include units manufactured by the four major companies supplying RBCs to municipalities. A calibrated electric power demand analyzer was employed in making power measurements. The facilities included in this survey had predominantly light and very light biofilm growths so the impact of heavy growth could not be determined. Most of the mechanical RBC units operated at relatively low power factors (0.19-0.82), even though many plants had capacitors installed on the main power supply for power correction. Blowers of the air-driven systems were often oversized to meet maximum demand, and throttling and speed reduction of the blowers was sometimes necessary during normal operation to reduce the air flow rate. Flexibility for process operation is extremely important. Design features to be considered should include removable baffles between stages in a train, provisions for flow diversion between adjacent trains, and ability to bypass part of the influent flow to a subsequent stage (stepfeed). Flexibility in flow distribution is particularly important in facilities where high flow variability is expected. Such flexibility permits optimization of the process in the most energy-efficient manner. (Rochester-PTT)
W86-05019

INTERACTIONS OF TEMPERATURE, PH, AND BIOMASS ON THE NITRIFICATION PROCESS,
King Saud Univ., Riyadh (Saudi Arabia). Coll. of Engineering.

N. K. Shammas.
Journal of the Water Pollution Control Federation, Vol. 58, No. 1, p 52-59, January 1986. 9 fig, 3 tab, 32 ref.

Descriptors: *Temperature, *Hydrogen ion concentration, *Nitrification, *Microbial mass, *Wastewater treatment, Ammonia, Oxidation, Mixed liquor solids, Activated sludge, Arrhenius relationship, Process control, Bacterial physiology, Efficiency, Mathematical models.

The effects of microbial mass, temperature, and hydrogen ion concentration on nitrification and how these factors affect the rate of ammonia oxidation in nitrifying activated sludge were studied. Ammonia oxidation rates were determined with varying mixed liquor volatile suspended solids (MLVSS) concentration, pH, and temperature, with all other environmental factors held constant. No interaction was observed between pH and temperature in their effect on the nitrification rate. MLVSS concentration influences the extent of temperature and pH effects so that there is a significant interaction between MLVSS and the other two variables. The values of the nitrification rate constant, k, ranged from 0.0085 per day at 4 C and pH 7 to 0.175 per day at 33 C and pH 8.3. A modified Arrhenius relationship was used successfully to estimate the change in nitrification rate with temperature. The extremely depressed nitrification rate at low ammonia concentrations indicate that high nitrification efficiencies can be obtained only with either an unreasonably long detention time or a combination of high mixed-liquor solids concentration and elevated temperature. An increase in the MVLSS concentration at very low temperatures does not significantly improve nitrification efficiency. (Rochester-PTT)
W86-05020

DESIGN OF TRICKLING FILTER NITRIFICATION TOWERS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
H. A. Gullicks, and J. L. Cleasby.
Journal of the Water Pollution Control Federation, Vol. 58, No. 1, p 60-67, January 1986. 5 fig, 4 tab, 16 ref.

Descriptors: *Design procedures, *Nitrification, *Trickling filters, *Ammonium, *Nitrate, *Wastewater treatment, Nitrification towers, Mathematical models, Fixed-film processes, Oxygen, Kinetics, Temperature, Wastewater facilities, Plastic media, Environmental Protection Agency.

Deficiencies in the United States Environmental Protection Agency (EPA) trickling filter nitrification design procedure are examined and new empirical design curves are proposed based on recent theoretical concepts and models for fixed-film processes. The new empirical nitrification tower design curves incorporate and properly account for four critical design parameters: the hydraulic loading rate, the trickling filter influent NH4+-N concentration; the effects of recycle; and the temperature of the wastewater. Application of the new curves is a fairly simple trial and error procedure. The oxidation of NH4+-N to nitrate in plastic media trickling filters seems to be flux-limited by oxygen at NH4+-N concentrations greater than about 4 mg/L. When NH4+-N removal is flux-limited by oxygen for the entire nitrification tower depth, it is possible to design the nitrification tower using zero-order kinetics (with respect to NH4+-N concentration) and a mass removal rate of approximately 1.17 x 10(-3) kg/day per sq m for wastewater temperatures greater than 14 C and hydraulic loading rates of 0.48 to 1.36 L/sq m per sec. For wastewater temperatures below 14 C, a different set of curves (included here) should be used because little oxygen flux-limited data were available at lower temperatures. The active or effective fraction of the plastic media surface appears to be on the order of 0.3 to 0.6. (Rochester-PTT)
W86-05021

ADSORPTION OF ORGANIC POLLUTANTS ON MONTMORILLONITE TREATED WITH AMINES,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W86-05022

EFFECTS OF NON-IDEAL COMPETITION ON MULTI-COMPONENT ADSORPTION EQUILIBRIA,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5F.
W86-05023

ACTIVATED SLUDGE CONTROL FOR SEASONAL NITRIFICATION,
J. E. Hart, R. Defore, and S. C. Chiesa.
Water Pollution Control Federation Journal, Vol. 58, N0. 5, p 358-363, May 1986. 5 fig, 2 tab, 17ref.

Descriptors: *Activated sludge, *Nitrification, *Seasonal nitrification, *Wastewater treatment, Ammonia, Aeration, Sludge, Biological oxygen demand, Secondary wastewater treatment, Organic loading.

To gain experience with controlled, seasonal nitrification, full-scale investigations were conducted during the summers of 1982, 1983, and 1984 by operating half of a secondary system to induce and subsequently inhibit nitrification. Control strategies developed by the Metro Plant (St. Paul, MN) process control staff were examined for their effectiveness in regulating nitrification during both transitional periods and extended operation. The experimentation was also used to determine potential problems with related liquid treatment and solids handling processes caused by operating the secondary treatment system for seasonal nitrification. The following conclusions have been formulated from these investigations: 1) Seasonal nitrification in a single sludge activated system can be controlled using an aeration intensity-based specific supply rate; 2) Required specific aeration supply rates are a function of NH3-N concentration, temperature, and organic loading rate; 3) Although single stage nitrification can be maintained at organic loading rates in excess of 0.20 kg BOD sub 5/kg mixed liquor suspended solids (MLSS) x d, the elevated specific oxygen uptake rates associated with higher organic loadings increase the potential for denitrification in the secondary clarifiers. An organic loading rate of 0.15 kg BOD sub 5/kg MLSS x d effectively eliminates denitrification; 4) Significantly more air must be supplied to ensure a rapid, trouble-free initiation than to sustain nitrification once it is achieved; 5) Selection of a proper aeration strategy can effectively control nitrification in the aeration tank yet, maintain a significant seed population of nitrifiers. Once growth conditions are suitable, very short lag periods are required before nitrification is complete; and, 6) Specific oxygen uptake rate or an equivalent sludge activity parameter would be a desirable fine-tuning element in a specific oxygen supply rate strategy. Any such device or analysis would have to directly account for attentuation of applied organic loading in the aeration basin. (Lantz-PTT)
W86-05030

EVALUATION OF HIGH DENSITY CROSS FLOW MEDIA FOR REHABILITATING AN EXISTING TRICKLING FILTER,
Valley Sanitary District, Indio, CA.
D. D. Drury, J. Carmona III, and A Delgadillo.
Water Pollution Control Federation Journal, Vol. 58, No. 5, p 364-367, May 1986. 4 fig, 2 tab, 5 ref.

Descriptors: *Wastewater treatment, *Trickling filters, *Cross flow media, *Rehabilitation, Activated sludge, Mathematical analysis, Velz equation, Biological oxygen demand, Effluents.

Since June of 1984, Valley Sanitation District has successfully operated a 21.3-m (70-ft) diameter shallow bed trickling filter with the use of high-density (138 sq m/cu m) cross-flow media was evaluated in a full-scale study. The data were analyzed by the modified Velz equation. The K sub 20 for the high-density media was .00471 (L/sq m.s) to the 0.5 power. The shallow bed trickling filter was loaded up to g/cu m.d BOD and consistently produced less than 35 mg/L effluent total BOD. The trickling filter has been operating for more than 2 years with no maintenance problems or evidence of media plugging. The results showed that the shallow bed cross flow media had significantly higher reaction rate coefficients than previously reported for cross-flow media in towers. The excellent performance of the shallow bed high-density cross-flow media makes it a prime candidate for replacement of rock media for capacity expansion in existing trickling filter plants. (Lantz-PTT)
W86-05031

EVALUATION OF TREATMENT PLANT PERFORMANCE: CAUSES, FREQUENCY, AND DURATION OF UPSETS,
Wisconsin Univ.-Madison. Dept. of Civil and Environmental Engineering.
P. M. Berthouex, and R. Fan.
Water Pollution Control Federation Journal, Vol. 58, No. 5, p 368-375, May 1986. 7 fig, 4 tab, 3 ref.
EPA Grant R809162010.

Descriptors: *Wastewater treatment, *Performance evaluation, Water quality management, Statistical analysis, Flow rates, Suspended solids, Dissolved oxygen.

Performance of fifteen well-operated treatment plants was studied. Preliminary data analysis used graphical and statistical smoothing methods to tentatively identify upsets, defined as episodes of uncharacteristically poor performance. These preliminary identifications were checked by visiting the plants to study the plant log and discuss the data with the plant operators. Upsets were classified into eight major catagories and 23 specific assignable causes. Most upsets were caused by operational factors and influent disturbances. Low dissolved oxygen, low mixed liquor suspended solids, high flow, and solids handling, the four most frequent causes of upsets, accounted for between 50 and 60% of all upsets. About 8 to 9 % of the days of record were affected by some kind of upsets. The average duration of upsets was 3.5 days, and 24% lasted 2 days or less. (Lantz-PTT)
W86-05032

PREDICTION OF NITRIFICATION IN WATER HYACINTH TREATMENT SYSTEMS,
State Univ. of New York at Buffalo. Dept. of Civil Engineering.
A. Scott Weber, and G. Tchobanoglous.
Water Pollution Control Federation Journal, Vol. 58, No. 5, p 376-380, May 1986. 4 fig, 3 tab, 7 ref.

Descriptors: *Nitrification, *Water hyacinth, *Wastewater treatment, Model studies, Hydraulic models, Ammonia, Data analysis.

According to the predictive model presented in this paper, nitrification is a function of hydraulic application rate, reactor distance, and a rate constant. The model was developed from fundamental concepts and simplified where warranted by experimental findings. The model was correlated to data with ammonium nitrogen concentrations between 0 and 45 mg/L NH4(+)-N while hydraulic application rates ranged from 9.91 to 19.9 cu m/sq m.d. Obviously these ranges do not encompass the full spectrum that would be expected in full-scale applications; however, within the ranges studied, there was excellent correlation between experimental findings and the model. Correlation to full-scale data is required to establish the validity of the proposed model. (Lantz-PTT)
W86-05033

DESIGN MODEL FOR THE OVERLAND FLOW PROCESS,
Robert S. Kerr Environmental Research Lab., Ada, OK.
J. L. Witherow, and B. E. Blesdoe.
Water Pollution Control Federation Journal, Vol. 58, No. 5, p 381-386, May 1986. 4 fig, 5 tab, 7 ref.

Descriptors: *Design standards, *Model studies, *Overland flow, *Wastewater treatment, Biological oxygen demand, Suspended solids, Organic carbon, Ammonia, Nitrogen, Phosphates, Primary wastewater treatment, Slopes.

A design model in the Process Design Manual, Land Treatment of Municipal Wastewater' was verified for biological oxygen demand (BOD) removal and further developed by field investigation to include total suspended solids (TSS), NH4, and total organic carbon (TOC) removal. Based on this study, the following conclusions (drawn in warm weather evaluations) were drawn: 1) Increasing the application rate of primary wastewater from 0.11 to 0.33 cu m/l/h, had a significant effect (p 0.05) on NO3, and NH4 concentrations and conductivity value, but not on TSS, total phosphate, BOD sub 5 and TOC concentrations and pH in the overland flow process; 2) The length of overland flow slopes had a significant effect (p 0.05) on BOD sub 5, TOC, TSS, total phosphate, NH4, and NO3 concentrations and on pH and conductivity values when raw wastewater was applied. Except for conductivity and total phosphate, this was also the case when primary wastewater was applied; 3) Those pollutants that showed the most consistent decrease in concentration throughout the slope length were BOD sub 5, TSS, NH4, and TOC; 4) Removal of BOD sub 5, TSS, NH4, and TOC from raw or primary municipal wastewater by the overland flow process is a first-order reaction. Linear regression analysis showing removal of these pollutants is described by C sub s/C sub 0 =Ae(-ks square root of q). The intercept constant A and rate coefficient k in this equation for these four pollutants are provided in this article. This equation and the collected data show secondary treatment criteria for BOD sub 5 and TSS can be met with overland flow slopes of 15 m when raw wastewater is applied and in less than 15 m when primary wastewater is applied during warm weather conditions. (Lantz-PTT)
W86-05034

PERFORMANCE OF SBR/DENITRIFICATION WITH A PRIMARY SLUDGE CARBON SOURCE,
Alfatch Univ., Tripoli (Libya). Dept. of Civil Engineering.
A. A. Abufayed, and E. D. Schroeder.
Water Pollution Control Federation Journal, Vol. 58, No. 5, p 387-397, May 1986. 11 fig, 6 tab, 31 ref. NSF Grant No. CEE 8200794.

Descriptors: *Sequencing batch reactors, *Denitrification, *Primary sludge, *Carbon, *Wastewater treatment, Organic carbon, Kjeldahl procedure, Nitrogen, Chemical oxygen demand, Hydrogen ion concentration, Effluents, Sludge.

Primary sludge from a domestic wastewater was used as an energy and carbon source in a laboratory-scale sequencing batch reactor (SBR) activated sludge denitrification system. Effluent total organic compound (TOC) and filterable total Kjeldahl nitrogen (TKN) were less than 10 mg/L and 2 mg/L, respectively. Oxidized nitrogen was completely removed. Chemical oxygen demand NO3-N ratios were greater than 7 at solids retention times from 6 to 24 days. pH increased during the SBR reaction cycle but did not exceed 8.7, an acceptable upper limit. Oxygen requirements for the system were very low. The reactors were aerated for 15 minutes before settling to remove accumulated gases. A cationic polyelectrolyte added during the aeration period resulted in less than 10 mg/L effluent suspended solids. (Lantz-PTT)
W86-05035

KINETICS AND STOICHIOMETRY OF SBR/DENITRIFICATION WITH A PRIMARY SLUDGE CARBON SOURCE,
Alfatch Univ., Tripoli (Libya). Dept. of Civil Engineering.
A. A. Abufayed, and E. D. Schroeder.
Water Pollution Control Federation Journal, Vol. 58, No. 5, p398-405, May 1986. 7 fig, 2 tab, 35 ref. NSF Grant No. CEE 8200794.

Descriptors: *Wastewater treatment, *Kinetics, *Stoichiometry, *Sequencing batch reactors, *Denitrification, *Primary sludge, Carbon, Organic carbons, Effluents, Suspended solids, Oxidation, Biodegradations, Ammonia, Nitrogen.

Kinetic parameters were established for denitrification in primary sludge and the effects of the type of organic source on the unit rate of denitrification were evaluated. These parameters define the operational characteristics of sequencing batch reactor (SBR)/primary sludge denitrification systems. Conclusions drawn from the study include: 1) Primary sludge is an excellent organic carbon source for denitrification in SBR activated sludge systems; 2) The denitrification rate in SBR systems is determined by the release rate of organic and nitrogenous matter from the primary sludge particulate solids; 3) The denitrification rate is affected by both the type and amount of organic carbon used to drive the denitrification reactions. When primary sludge is used as a carbon source, the denitrification rate is directly related to the feed sludge total suspended solids (TSS); 4) Under non-nitrogen-limiting conditions, nitrate removal rates are zero-order for both soluble and hydrolyzed particulate carbon sources; 5) The denitrification rate is independent of SRT between 6 and 12 days; 6) Utilization of organic carbon sources other than primary sludge is possible only if the bacterial mass is properly acclimated to these sources; and 7) Small concentrations of ammonia are essential for cell synthesis requirements so that dissimilatory denitrification will not be rate-limiting. (Lantz-PTT)
W86-05036

IMPROVED ALKALIMETRIC MONITORING FOR ANAEROBIC DIGESTION OF HIGH-STRENGTH WASTES,
Wisconsin Univ.-Madison. Coll. of Engineering.
L. E. Ripley, W. C. Boyles, and J. C. Converse.
Water Pollution Control Federation Journal, Vol. 58, No. 3, p 406-411, May 1986. 13 fig, 7 ref.

Descriptors: *Alkalimetric monitoring, *Wastewater treatment, *Anaerobic digestion, *Monitoring manure, Animal wastes, Poultry, Methane, Alkalinity, Chemical analysis, Volatile acids.

Poultry manure is a high-strength waste that presents both a disposal problem and an energy-recovery opportunity. The U.S. currently has approximately 280 million egg-laying hens in production. Each hen produces 110 to 150 g (0.25 to 0.33 lb) of manure per day. A bench-scale poultry manure digestion study was undertaken on methane optimization and stability monitoring, measure methane production rates were normal in identical digesters with different HRTs and different influent solids concentrations. All other variables (mixing, heating, and influent composition) were held constant throughout the study. Methods to measure the biological stability of anaerobic digestion were evaluated so that the onset of a process upset can be quickly, easily, and inexpensively detected, and remedial action taken before failure. Methods include: 1) Titration of the centrifuged sample to an endpoint of pH 5.75 partial alkalinity (PA), and then to pH 4.3 intermediate alaklinity (IA) makes it possible to distinguish the relative buffering contributions of both bicarbonate and volatile acids (VA) in the anaerobic digestion of a high-strength waste such as poultry manure. Additionally, IA provides a rapid, semi-quantitative estimate of TVA concentration; 2) IA:PA is a simple, inexpensive, yet sensitive digestion monitoring tool which increases rapidly with a process upset then decreases with recovery. IA:PA is analogous to the VA-to-Alkalinity ratio, but it does not require VA measurement. The ratio is dimensionless; there is no need for precise titrant standardization and sample volume measurement; and 3) IA:PA is also useful to compare steady-state operating configurations in a bench-scale digestion study. Successful digestion of poultry manure occurred with IA:PA below 0.3. (Lantz-PTT)
W86-05037

STATE-OF-THE-ART UPDATE ON COMBINED SEWER OVERFLOW CONTROL,
Municipal Environmental Research Lab.-Cincinnati, Edison, NJ. Storm and Combined Sewer Section.
R. Field.
Critical Reviews in Environmental Control, Vol. 16, No. 2, p 147-165, 1986. 5 fig, 4 tab, 113 ref.

Descriptors: *Combined sewer overflows, *Storm water, *Wastewater treatment, Instrumentation, Simulation models, Toxicity, Bacteria, Oxygen demand, Suspended solids, Aesthetics, Economics, Catchbasins, Sewer flushing, Polymeric injection, Flow routing, Regulators, Tide gates, Hydrobrakes, Maintenance, Physical treatment, Chemical treatment, Disinfection, Biological treatment, Design guidelines.

Accomplishments, methods, and products employed in dealing with the combined sewer overflow (CSO) problem are reviewed under the following headings: pollution problem assessment (characterization and receiving water impacts), user's assistance tools (instrumentation, simulation models), solution methodology, management alternatives (land management, collection system controls, treatment, and sludge/solids), integrated systems (storage/treatment, dual-use wet-weather flow/dry-weather flow facilities, and control/treatment/reuse), and recommendations for the future (receiving water impacts, toxics characterization and control/treatment, sewer system cross connections, integrated stormwater management, institutional socio/economic conflicts). Land management alternatives discussed include porous pavement and surface sanitation. Collection system controls are catchbasins, sewers, sewer flushing, polymeric injection, flow routing, regulators and tide gates, hydrobrakes, maintenance, and storage. Treatment methods discussed are physical/chemical treatment, biological treatment, disinfection, treatment/control design guidebook, and treatment process performance. On a mass basis, toxics, bacteria, oxygen demanding material, suspended solids, and visual matter in CSO and urban stormwater cannot be ignored. The integrated approach to wet-weather pollution control is the only way that is going to be feasible and economical. (Rochester-PTT)
W86-05038

WASTEWATER DISINFECTION--TIME FOR A CHANGE,
Pennsylvania Dept. of Environmental Resources, Harrisburg.
R. H. Schertzer.
Journal of the Water Pollution Control Federation JWPFA, Vol. 58, No. 3, p 174-180, March 1986. 4 fig, 2 tab, 35 ref.

Descriptors: *Disinfection, *Water quality standards, *Wastewater treatment, *Water quality, Recreation, Drinking water, Bioindicators, Coliforms, Human diseases, Monitoring, Public health.

Most disinfection requirements in the U.S. are designed to protect recreational and drinking water by controlling coliform bacteria. However, the current widely used standard of 200 fecal coliform colonies per 100 ml is not supported directly by epidemiological evidence; recent information relating disease incidence in recreational water users to in-stream densities of various indicator organisms suggests enterococci or E. coli are more accurate and reliable indicators of freshwaters of potential health significance. Serious consideration should be given to changing existing regulatory approaches based on fecal coliforms, and efforts should be made to standardize analytical methods for enumerating these organisms. (Doria-PTT)
W86-05046

STUDY OF OPERATIONAL ULTRAVIOLET DISINFECTION EQUIPMENT AT SECONDARY TREATMENT PLANTS,
CRS Sirrine, Inc., Greenville, SC.
S. C. White, E. B. Jernigan, and A. D. Venosa.
Journal of the Water Pollution Control Federation JWPFA, Vol. 58, No. 3, p 181-192, March 1986. 6 fig, 3 tab, 10 ref. EPA Contract 68-03-1821.

Descriptors: *Disinfection, *Secondary wastewater treatment, *Ultraviolet radiation,

Wastewater facilities, Design criteria, Performance evaluation, Chlorination.

Ultraviolet disinfection of potable and industrial water has been practiced for several years; however, its use in secondary wastewater treatment is more recent. Plant operations personnel prefer the UV systems over chlorination because of its relative safety and reduced labor requirements. A survey identified 52 UV systems currently operating in the U.S. and Canada. Six sites were inspected, providing examples of both successes and problems with the process. Most of the problems encountered were unrelated to the UV process itself, and resulted from electrical, mechanical, and hydraulic problems. In some cases, equipment design was inconsistent with good engineering application of the fundamentals of UV disinfection theory. Treatment plant design engineers should become better acquainted with UV process details, and should have access to relevant data or guidance documents. (Doria-PTT)
W86-05047

DISINFECTION OF LOW QUALITY WASTEWATERS BY ULTRAVIOLET LIGHT IRRADIATION,
Canviro Consultants Ltd., Toronto (Ontario).
G. Zukovs, J. Kollar, H. D. Monteith, K. W. A. Ho, and S. A. Ross.
Journal of the Water Pollution Control Federation JWPFA, Vol. 58, No. 3, P 199-206, March 1986. 8 fig, 7 tab, 19 ref.

Descriptors: *Disinfection, *Low quality wastewaters, *Wastewater treatment, *Ultraviolet radiation, Combined sewer overflows, Cost analysis, Chlorination, Pathogenic bacteria, Bioindicators.

Ultraviolet light irradiation is an effective alternative for disinfecting secondary and tertiary wastewaters, and its use may be extended to low quality effluents such as combined sewer overflows (CSOs). Advantages of UV disinfection of low quality wastewaters include a high degree of bacterial inactivation and production of disinfected effluent that is nontoxic to receiving water biota. In experiments using simulated CSO, UV light significantly reduced both indicator organisms and pathogenic bacteria, although dosage costs for UV irradiation of CSO were found to be consistently higher than chlorination/dechlorination for flow rates between 5,000 and 500,000 cu m/d; operation and maintenance costs for both types of facilities were similar. (Doria-PTT)
W86-05049

EFFECTS OF SYNTHETIC POLYELECTROLYTES ON SELECTED AQUATIC ORGANISMS,
Environmental Research Lab.-Duluth, MN.
For primary bibliographic entry see Field 5C.
W86-05050

FLOCCULATOR-CLARIFIER PERFORMANCE,
Brown and Caldwell, Walnut Creek, CA.
D. Parker, and R. Stenquist.
Journal of the Water Pollution Control Federation JWPFA, Vol. 58, No. 3, p 214-219, March 1986. 5 fig, 5 tab, 6 ref.

Descriptors: *Flocculation, *Clarification, *Wastewater treatment, Sedimentation, Design criteria, Activated sludge, Trickling filter, Performance evaluation, Cost analysis, Capital costs.

Improvements in secondary sedimentation tank design and proper preparation of the biological floc can yield tertiary quality secondary effluents; this has been demonstrated for both the activated sludge and trickling filter/solids contact processes. Performance data show that deep flocculator-clarifiers can produce effluents with average suspended solid concentrations of 10 mg/l or less at average overflow rates up to 2.0 m/h. In comparison, conventional clarifiers with shallow sidewater depths degrade rapidly with increased overflow rates. The cost of increasing clarifier depth is offset by the need to construct fewer clarifiers. The additional cost of the larger flocculation center is minimal, since only a larger baffle is provided and the overflow rate is not derated for the center well area. (Doria-PTT)
W86-05051

INHIBITION KINETICS OF NITRIFICATION IN CONTINUOUS-FLOW REACTORS,
Delaware Univ., Newark. Dept. of Civil Engineering.
A. F. Rozich, and D. J. Castens.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 3, p 220-226, March 1983. 8 fig, 5 tab, 22 ref. OWRT Grant No. 14-08-0001-G833/07.

Descriptors: *Inhibition, *Kinetics, *Nitrification, *Continuous-flow reactors, *Ammonia, *Wastewater treatment, Mathematical equations, Mathematical analysis, Haldone equation, Monod equation, Sludge digestion, Water pollution control.

The purpose of this research was to determine an appropriate growth rate function (mu versus S relationship) that should be used to describe the growth of nitrifying organisms limited by exogenous ammonia. A two-stage continuous culture system was fed a synthetic ammonia waste devoid of organic carbon to assess the nature, inhibitory or non-inhibitory, of ammonia-limited nitrification. The results of these studies indicated that nitrifier growth kinetics are best represented with a substrate inhibition function such as the Haldane equation. Data from these studies suggested that nitrifier growth followed an inhibitory pattern which means that the use of the Monod equation for representing nitrification is mechanistically inappropriate. The mu versus S(NH4(+)-N) data that were collected in the continuous-flow system were fit to the Haldane equation. The substrate inhibition nature of nitrifier kinetics provides some explanation of the instabilities often encountered with nitrification performance in treatment plant facilities. Consequently, it is desirable to implement operating strategies that will provide the greatest degree of stability to substrate removal kinetics in the aeration basin. Implementation of these strategies should result in more consistent performance with regard to ammonia removal for nitrifying activated sludge systems. (Lantz-PTT)
W86-05052

ANAEROBIC TREATMENT OF PHENOL BY AN EXPANDED-BED REACTOR,
Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.
Y. T. Wang, M. T. Suidan, and B. E. Rittman.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 3, p 227-233, March 1986. 8 fig, 3 tab, 21 ref. EPA Contract No. EPA R-809750-01.

Descriptors: *Anaerobic digestion, *Phenols, *Expanded-bed reactors, *Wastewater treatment, Water pollution control, Activated carbon, Chemical oxygen demand, Organic carbon, Methane, Bacteria, Organic compouds.

The objective of this study was to evaluate the effect of influent phenol concentration on performance of the expanded-bed granular activated carbon (GAC) reactor. The organic removal efficiency of an expanded-bed anaerobic reactor using granular activated carbon as a biological attachment medium was very high when subjected to a wide range of feed phenol concentrations. During 588 days of continuous operation, four steady-state conditions were obtained under feed phenol concentrations of 358, 716, 1432, and 2864 mg/L. Steady-state phenol, chemical oxygen demand (COD), and dissolved organic carbon (DOC) removal efficiencies exceeded 99.9, 92, and 93%, respectively, even for the highest loading conditions. By the end of this study, 87.5% of the feed COD was converted to methane gas. Only 6% of the feed COD escaped in the aqueous effluent from the anaerobic reactor. The high conversion to methane and the low retention of COD within the reactor demonstrate that biological utilization was the major removal mechanism and the net growth of bacteria in the reactor was low. The major conclusion of this study was that the granular activated carbon expanded-bed reactor achieved nearly 100% removal of phenol when the surface loading ranged from 0.028 to 0.23 mg/sq cm/d COD. The expanded-bed reactor responded favorably to the sudden doubling of feed phenol concentration. Gas production from the reactor increased rapidly immediately after the increase in organic load. Gas production doubled within a week after the feed phenol concentration was doubled, but increases in effluent phenol concentrations were small. The use of partially saturated granular activated carbon media and phenol-acclimated activated carbon in inocula enabled biological utilization of phenol to start in 8 days. (Lantz-PTT)
W86-05053

ADSORPTION OF LEAD AND ZINC ON BLAST FURNACE IRON OXIDE SOLIDS,
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
J. R. Mihelcic, and R. G. Luthy.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 3, p 242-249, March 1986. 12 fig, 1 tab, 33 ref. EPA Grant No. R 809628.

Descriptors: *Adsorption, *Lead, *Zinc, *Iron oxides, *Solids, *Industrial wastes, *Wastewater treatment, Hydrogen ion concentration, Model studies, Chemical analysis, Chemical precipitation, 1-Hydroxyethylidene-1, -1-diphosphonic acid.

The purpose of this investigation was to develop a model to describe lead and zinc adsorption on iron oxide solids, and to evaluate the effect of solids concentration and the presence of an antiscalant additive on metal ion adsorption. These phenomena are important for evaluating the fate of lead and zinc in blast furance recycle scrubber water and for satisfying effluent limitation requirements in blowdown from the recycle system. This study evaluated the adsorption of lead and zinc on blast comprised of iron oxides, and metal adsorption was measured for several solids concentrations as a function of pH. The metals displayed characteristic pH-adsorption edges which were displaced to more alkaline pH values at lower solids concentration. The desorption-adsorption of relatively high concentrations of lead (29 mg/L) and zinc (250 mg/L) at high solids concentration (50 mg/L) can be described by a surface chemical model in which the metal-solid interaction was interpreted as a surface complex. The removal of relatively high concentrations of zinc in the presence of relatively low solids concentration (1 mg/L) depended more on chemical precipitation than surface adsorption, while the removal of relatively high concentrations of zinc in the presence of moderately high solids concentration (5 and 10 g/L) seemed to depend in part on adsorption and in part on lowered solubility product for Zn(OH)2(s) at the solid solution interface. Metal adsorption tests with the iron oxide solids in the presence of an organophosphonate antiscalant compound demonstrated that the compound exhibited a competing reaction for the removal of either lead or zinc from solution by surface adsorption/chemical precipitation. The general characteristics of zinc adsorption on iron oxide in the presence of 1-hydroxyethylidene-1, 1-diphosphonic acid (HEDP) could be described at best qualitatively if metal adsorption, chemical precipitation, and chemical complexation with HEDP are considered simulataneously. Improvement in modeling the adsorption of metal in the presence of HEDP antiscalant requires specific information on adsorption characteristics of the metal-HEDP complex. (Lantz-PTT)
W86-05055

BLAST FURNACE RECYCLE WATER QUALITY AND REACTIONS OF LEAD AND ZINC,
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W86-05056

OXIDATION OF 2-CHLOROPHENOL USING OZONE AND ULTRAVIOLET RADIATION,

New Jersey Inst. of Tech., Newark.
S. R. Khan, C. R. Huang, and J. W. Bozzelli.
Environmental Progress, Vol. 4, No. 4, p 229-235, November 1985. 11 fig, 1 tab, 17 ref, append.

Descriptors: *Ozone, *Priority pollutants, *Hazardous wastes, *Ultraviolet radiation, * 2-Chlorophenol, *Oxidation, Industrial wastes, Wastewater treatment, Organic compounds, Mathematical models, Kinetics, Degradation.

Ozone has been found to be an effective oxidizing agent for the removal of many organic pollutants from water. The technique is more effective in the presence of ultraviolet light; oxidation rates with ozone/UV are 10 to 1,000 times faster than with ozone alone. Experimental data and proposed kinetic schemes are presented for the oxidation of 2-chlorophenol with ozone, with ultraviolet light, and with ozone/UV combined. The purpose is to develop a mechanistic expression for the ozone/UV process, from which, knowing the given ozone dose rate and UV intensity, the disappearance curve for any substrate may be predicted, or its degradation modeled and optimized for the application. Specific kinetic rates were determined based upon experimental results from a series of reactions on 2-chlorophenol using an optimization program on a computer. The experimental results and rate constants computed from them are presented and discussed, and details of the mass transfer and kinetic models are given. It is also shown that this type of reaction system has a high degree of potential for destruction of refractory organic water pollutants in industrial effluents. (Doria-PTT)
W86-05057

EFFECTS OF CHLORINE AND AMMONIA FROM WASTEWATER TREATMENT FACILITIES ON BIOTIC INTEGRITY,
Illinois Univ. at Urbana-Champaign. Dept. of Ecology, Ethology and Evolution.
For primary bibliographic entry see Field 5C.
W86-05067

RELIABLE OZONE DISINFECTION USING OFF-GAS CONTROL,
Canviro Consultants Ltd., Kitchener (Ontario).
A. D. Venosa, L. A. Rossman, and H. L. Sparks.
Journal of the Water Pollution Control Federation JWPFA, Vol. 57, No. 9, p 929-934, September 1985. 9 fig, 13 ref.

Descriptors: *Ozone, *Disinfection, *Off-gas control, Wastewater treatment, Coliform density, Effluents, Mathematical, Analysis.

The electrical energy used in the manufacture of ozone constitutes a major part of the operating cost of disinfection. Presently, the control of ozone disinfection at existing wastewater treatment facilities is usually practiced in one of two ways: either the applied dose or the rate of production is held constant at all levels of liquid flow. What is needed is a means of automatically adjusting the control of ozone disinfection as both liquid flow and ozone demand fluctuate with time. Off-gas concentration and contact time can be empirically correlated with coliform density and thus be used as the basis for a process control strategy. An experimental ozonation pilot unit was used to disinfect a municipal treatment plant effluent over a period of 7 months. The results showed that it is possible to empirically relate effluent fecal coliform densities to the product of off-gas concentration and liquid contact time. The ozone disinfection process can be controlled to meet an effluent fecal coliform limit reliably by maintaining a fixed set-point consisting of the product of off-gas concentration and contact time. Adjustment of point during real-time operation to compensate for changes in factors effecting the coefficients of the performance model can be made by using a sequential estimation scheme. (Khumbatta - PTT)
W86-05068

PHOSPHORUS REMOVAL AT THE LOWER MOLONGO WATER QUALITY CONTROL CENTRE,
Department of Housing and Construction, Canberra (Australia).
D. Philp.
Journal of the Water Pollution Control Federation, Vol. 57, No. 8, 846, August 1985. 9 fig, 2 ref.

Descriptors: *Wastewater treatment, *Phosphorus removal, *Recreation, Primary wastewater treatment, Suspended solids, Organic matter, Chlorination, Operating costs, Physicochemical treatment, Chemical treatment, Murrumbidgee River, Burrinjuck Reservoir, Activated sludge process, Filtration, Biological wastewater treatment.

The Lower Molongo Water Quality Control Center (LMWQCC) was constructed during the mid-1970s to treat wastewater from Canberra, Australia. It was designed to produce an effluent that would not affect the aquatic habitats and the anticipated recreational use of the Murrumbidgee River and Burrinjuck Reservoir downstream of Canberra. In this wasterwater treatment facility, the physical and chemical treatment processes are combined to achieve maximum removal of suspended and organic material and phosphorus in the primary treatment stage. The use of ferrous chloride in a two-stage phosphorus removal process reduced total phosphorus to <0.2 mg/L and lowered operating costs. Ferrous chloride chlorination to ferric chloride for the second stage of phosphorus removal offers an economic approach to achieving a low concentration of phosphorus in the effluent following filtration. The phosphorus objectives could also be achieved by adding a ferrous salt to the activated sludge process followed by effluent filtration provided no biological processes are required between the activated sludge plant and the final filters. The use of the iron salt improves activated sludge settlability with low organically loaded activated ssludge processes. (Khumbatta-PTT)
W86-05081

RELATIONSHIP BETWEEN SVI AND ACTIVATED SLUDGE SETTLING CHARACTERISTICS,
CH2M/Hill, Denver, CO.
G. T. Daigger, and R. E. Roper, Jr.
Journal of the Water Pollution Control Federation, Vol. 57, No. 8, 866, August 1985. 8 fig, 4 tab, 21 ref, Append.

Descriptors: *Activated sludge, *Settling flux theory, *Sludge volume index, *Wastewater treatment, Clarifiers, Design criteria, Pilot plants.

Research by various investigators has led to the development and general acceptance of settling flux theory describing the solids thickening function of activated sludge clarifiers. Direct application to specific designs, troubleshooting, and daily operational control has been limited because there is no simple technique for obtaining the necessary data to use the settling flux theory. The objective of this srsearch was to correlate batch settling test data with sludge volume index (SVI) to develop a practical means for estimating activated sluged settling characteristics and allow the benefits of solids flux theory to be more fully realized. A total of 236 individual settling velocities were measured, and the results were pooled into various SVI categories and fitted to an empirical model. The relationship was then used to develop an operational chart, with SVI as a parameter, which allows design engineers and plant operators to apply settling flux theory easily and directly and in a manner that eliminates the somewhat cumbersome graphical approach traditionally used for settling flux analysis. (Khumbatta-PTT)
W86-05082

CHEMISTRY, MICROBIOLOGY, AND MODELING OF CHLORINATION FOR ACTIVATED SLUDGE BULKING CONTROL,
California Univ., Berkeley. Dept. of Civil Engineering.
J. B. Neethling, D. Jenkins, and K. M. Johnson.
Journal of the Water Pollution Control Federation JWPFA, Vol. 57, No. 8, p 882-889, August 1985. 15 fig, 2 tab, 23 ref, Append. National Science Foundation Grant No.CME-8006295.

Descriptors: *Activated sludge process, *Chlorination, Bulking sludge, *Wastewater treatment, Mathematical models, Kinetics, Biological wastewater treatment.

Bulking is caused by the uncontrolled outgrowth of large amounts of filamentous microorganisms in activated sludge. Chlorine has been used to control activated sludge bulking. A model describing the kinetics of activated sludge bulking control by chlorination was presented. The model predicts that there is a limiting frequency of exposure of solids inventory to chlorine below which it is not possible to prevent bulking by adding chlorine. The limiting frequency is determined by the difference in the growth rates of the filamentous and floc-forming microorganisms (the bulking potential), the relative amounts of filamentous and forming microorganisms, and the relative survival of filamentous and floc-forming organisms when dosed with chlorine. The comcept of a limiting frequency of exposure, predicted by the kinetic model, was supported by laboratory- and field-scale experiments in activated sludge systems that bulked because of DO deficiency. The laboratory activated sludge systems were operated at a high bulking potential and required a frequency of exposure of 3/d to control bulking by chlorination. In the prototype systems the bulking potential was lower and a lower frequency of exposure seemed satisfactory in controlling bulking. These results suggest that a savings in chlorine could accrue in plants where high exposure frequencies exists; chlorine could be dosed for only part of a day, to approach the limiting frequency. (Khumbatta - PTT)
W86-05083

SIMPLICITY IS MARK OF PUMP STATION IN THE ROUND,
For primary bibliographic entry see Field 8C.
W86-05120

SLUDGE MANAGEMENT GOES THE DISTANCE,
Brown and Caldwell, Denver, CO.
For primary bibliographic entry see Field 5E.
W86-05121

AT THE ROOT OF THE MATTER,
R. A. J. Arthur.
Water & Waste Treatment, Vol. 29, No. 3, p 35. 48, March 1986.

Descriptors: *Wastewater treatment, *Great Britain, *Root zone, *Kickuth Root Zone Biotechnology, Phragmites, Denitrification, *Aerobic treatment *Anaerobic treatment, Biological treatment, Sludge dewatering, Reeds, Heavy metals, Ammonia, Sumps.

The Kickuth Root Zone Biotechnology (RZB) system of wastewater treatment offers marked advantages in removal of contaminants, flexibility, energy saving and cost. The Kickuth RZB plant looks like a stretch of marshland overgrown with reeds, but it replaces the conventional sewage works, extracts nitrates, phosphates, phenols, hydrocarbons and mineral waste, and wipes out harmful bacteria. It can be made small or large (from a single household up to about 60,000 people) and is self adjusting to sudden changes in the amount of effluent. The system exploits the abilities of certain reeds (Phragmites) and other marsh plants to absorb oxygen through their pores above ground in air and transport it to the root zone, where it enters the surrounding soils. Roots can run as deep as 1.2 m. The dense root network oxidizes the soil and provides a hydraulic pathway. Plants are being developed with exceptional resistance to flooded soils, high concentrations of ammonia, and heavy metals. The entire reed bed is isolated from ground water by clay, bentonite, or other material, usually at a depth of 0.6 m. The effluent is induced by a slight slope to run horizontally through the root zone from inlet to outlet, and into a collection sump. The RZB system is a natural zeolyte. Activity in the root zone is both aerobic and anaerobic. Denitrification occurs in two phases, the oxidation of nitrogen compounds

under aerobic conditions with an oxidation potential > 320 mV, and under anaerobic conditions with an oxidation potential < 320 mV. The removal of nitrogen is accompanied by an active removal of organic materials. RZB can also provide an integrated means for the treatment of sludge wastewater. The great evapotranspiration of reeds (about 1500 to 1800 mm) can be utilized in helping to dehydrate otherwise difficult sludges. (Peters-PTT)
W86-05122

BIOFILM ON REVERSE OSMOSIS MEMBRANES,
Orange County Water District, Fountain Valley, CA.
H. F. Ridgway, D. M. Rodger, and D. G. Argo.
Water & Waste Treatment, Vol. 29, No. 3 p 44, 46, 48, March 1986. 3 tab, 3 fig.

Descriptors: *Biofilm, *Reverse osmosis, *Fouling, California, Wastewater treatment, Secondary effluent, Bacteria, Bioassay, Mycobacterium, Detergents, Spectrophotometry, Surfactants.

The fundamental mechanism of the biofouling process in reverse osmosis (RO) plants is studied. An in vitro bacterial adhesion assay technique was applied to study the adhesion and fouling properties of specific fouling micro organisms. The organism is an acid fast Mycobacterium species, strain BT2-4, previously isolated from an early membrane biofilm. The bacteria were incubated and uniformly radio labelled with tritium so that concentrations of Mycobacteria could be identified with a liquid scintilation spectrometer. The washed radio labelled mycobacteria were diluted and introduced into vials covered by a cellulose acetate RO membrane disc. The vials were sealed, placed in an inverted position, adhesion was allowed to proceed at 30 C while the vials were gently shaken. At the end of the incubation period the RO membrane discs were rinsed clear and the bacteria adhering to the membrane determined through the use of a liquid scintillation counter. Octyl phenoxy polyethoxyethanol (Triton X-100) shows the best inhibition while two of the quaternary ammonium compounds promote adhesion. The best results were found when the surfactant was added prior to cell adhesion. A relationship exists between the structure of a detergent molecule and its ability to influence microbial adhesion to RO membranes surface. (Peters-PTT)
W86-05123

MONITORING AND EVALUATING COMPOSTING PROCESS PERFORMANCE,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5E.
W86-05130

MUNICIPAL SLUDGE COMPOSTING TECHNOLOGY EVALUATION,
Brown and Caldwell, Walnut Creek, CA.
For primary bibliographic entry see Field 5E.
W86-05131

ACCURACY AND PRECISION OF PLANT SCALE AND SHOP CLEAN WATER OXYGEN TRANSFER TESTS,
Michigan Technological Univ., Houghton. Dept. of Civil Engineering.
C. R. Baillod, W. L. Paulson, J. J. McKeown, and H. J. Campbell, Jr.
Journal of Water Pollution Control Federation, Vol. 58, No. 4, p 290-299, April, 1986. 5 fig, 10 tab, 9 ref.

Descriptors: *Sludge conditioning, *Activated sludge process, *Aeration, *Performance evaluation, *Oxygenation, Dissolved oxygen, Regression analysis, Mathematical studies, Comparison studies, Oxygen transfer, Wastewater treatment, Activated sludge.

Accurate oxygen transfer rates at given power inputs of activated sludge aeration processes are necessary for evaluation and acceptance testing of equipment. This study evaluated the accuracy, precision, and applicability of such measurements made according to a clean water test standard developed by the American Society of Civil Engineers (ASCE) Oxygen Transfer Standards Committee. The standard requires that performance be evaluated by a minimum of three replicate tests with the measured standard oxygen transfer rate (SOTR) taken as the average of all valid replicates. The results of replicate shop and plant-scale clean water oxygen tests showed that the precision of the SOTR measurement is very good. Results of parallel but independent oxygenation and krypton stripping measurements on two plant-scale tests gave very good agreement between SOTR values. SOTR values given by the nonlinear regression (NLR), log deficit-measured saturation (LD), and best fit log deficit (BFLD) methods of parameter estimation generally agreed within = or - 3% of each other. The ASCE Clean Water Standard can be successfully applied to a wide variety of aeration equipment and tank configurations including coarse and fine bubble diffused air, single and multiple surface aeration, oxidation ditches and static tubes. (Geiger-PTT)
W86-05132

EVALUATION OF FACTORS AFFECTING THE OXYGEN TRANSFER FROM HIGH-SPEED FLOATING SURFACE AERATORS,
Eastman Kodak Co., Rochester, NY.
R. A. Poduska, and R. F. Hager, Jr.
Journal of Water Pollution Control Federation, Vol. 58, No. 4, p300-305, April 1986. 4 fig, 4 tab, 10 ref.

Descriptors: *Aeration, *Activated sludge process, *Oxygen transfer, *Dissolved oxygen, *Wastewater treatment, Aerators, Oxygenation, Performance evaluation, Oxygen uptake.

A study was conducted to evaluate the primary reason for a sudden and extended lack of adequate dissolved oxygen (DO) in an activated sludge system with only high-speed floating surface aeration. Based on preliminary evaluations that the influent biochemical oxygen demand (BOD) load had not increased during this imbalance, efforts were concentrated on identifying the cause of a decrease in the supply of oxygen from the aeration equipment of the wastewater treatment plant. Results of this evaluation showed that changes in the mechanical integrity of the aerators had a significant impact on the overall oxygen transfer capacity of the system. The DO deficit in the surface activated sludge system was the result of reduced aerator oxygen transfer efficiency caused by damage to the impellers. A periodic survey of individual aerator power, and necessary maintenance based on low values generates significant cost savings. (Geiger-PTT)
W86-05133

EFFECT OF BIOMASS ON OXYGEN TRANSFER IN RBC SYSTEMS,
Rome Univ. (Italy). Dept. of Chemical Engineering.
A. E. Paolini.
Journal of Water Pollution Control Federation, Vol. 58, No. 4, p 306-311, April, 1986. 4 fig, 2 tab, 15 ref.

Descriptors: *Oxygen transfer, *Aeration, *Biomass, *Biological membranes, *Oxygen uptake, *Wastewater treatment, Oxygenation, Turbulent flow.

The effect of reactor liquid turbulence in a rotating biological contactor (RBC) on oxygen transfer was studied when the aeration is occurring with and without biomass and at varying disk rotational speeds. In addition the enhancement of oxygen transfer that results from the biomass at different disk rotational speeds was examined. Three types of experiments were performed with laboratory-scale RBC systems. First, biological tests were performed at a fixed organic loading rate to study the effect of rotational speed on overall biochemical oxygen transfer coefficient. Second, physical oxygen transfer tests were performed to evaluate the overall physical oxygen transfer coefficient at different rotational speeds. Finally, the sulfite technique was adopted to estimate how the reactor liquid turbulence contributed to total oxygen transfer. Results showed that in the absence of biomass, aeration through the liquid film is the dominant mechanism for physical oxygen transfer only when bench-scale RBC units are operated at high disk rotational speeds. At low velocities, the contribution of reactor liquid turbulence is significant to total physical oxygen transfer. The biomass enhances the oxygen transfer rate with respect to the rate in clean water. This enhancement is especially significant at low rotational speeds and probably results from enhancement of oxygen diffusion through the liquid film as a consequence of the oxygen consumption by the biofilm and increased surface area for transfer. (Geiger-PTT)
W86-05134

DESIGN OF RAPID SMALL-SCALE ADSORPTION TESTS FOR A CONSTANT DIFFUSIVITY,
Michigan Technological Univ., Houghton. Dept. of Civil Engineering.
J. C. Crittenden, J. K. Berrigan, and D. W. Hand.
Journal of the Water Pollution Control Federation, Vol. 58, No. 4, p 312-319, April, 1986. 4 fig, 3 tab, 37 ref. append. NSF Grant CEE-8300213.

Descriptors: *Separation techniques, *Wastewater treatment, *Water treatment, *Activated carbon, *Adsorption, Models, Pilot plants, Diffusion coefficients, Mathematical studies, Design criteria.

A rapid method for large-scale, fixed-bed adsorber design from small column studies, known as the rapid small-scale column test (RSSCT), was developed and evaluated. In the RSSCT method, mathematical models are used to scale-down the full-scale adsorber to an RSSCT and maintain perfect similarity between the performance of the adsorber. A dimension analysis on the dispersed flow, pore surface diffusion model (DFPSDM) was used to determine scaling factors because th DFPSDM includes many of the known transport and kinetic phenomena that occur in fixed-bed adsorbers. Results showed that full-scale adsorber performance may be predicted in less time and at less expense with RSSCT than with a pilot study by plotting the effluent concentration history in terms of the bed volumes fed. The RSSCTs use a smaller size GAC (granular activated carbon) that is prepared from GAC to be used in the full-scale process. Several RSSCTs may be used to rapidly evaluate several fluid residence times in the beds of important process configurations such as beds in series or in parallel. A laboratory verification of the RSSCT was conducted and good agreement was found between the laboratory pilot-scale adsorbers and the RSSCT breakthrough profiles. (Geiger-PTT)
W86-05135

MODELING AND PERFORMANCE OF THE ACTIVATED SLUDGE-POWDERED ACTIVATED CARBON PROCESS IN THE PRESENCE OF 4,6-DINITRO-O-CRESOL,
Universidad Autonoma Metropolitana, Mexico City. Dept. of Hydraulic Engineering.
J. H. Garcia-Orozco, H. R. Fuentes, and W. W Eckenfelder, Jr.
Journal of the Water Pollution Control Federation, Vol. 58, No. 4, p 320-325, April 1986. 9 fig, 2 tab, 21 ref.

Descriptors: *Mathematical models, *Activated sludge process, *Activated carbon, *Theoretical analysis, *Organic compounds, *Wastewater treatment, Performance evaluation, Activated sludge, Organic carbon, Models, Industrial wastes, Biodegradation, Separation techniques, Adsorption.

This study aimed to model the activated sludge-powdered activated carbon process (AS-PAC) and to determine any difference in performance parameters with respect to the activated sludge process in the presence of 4,6-dinitro-o-cresol (DNOC). Experimental results showed that the assumptions on which the overall removal model is based were satisfied. In the presence of activated carbon on a total organic carbon basis, the biodegradation rate coefficient increases and the nondegradable frac-

tion remaining decreases. In the model proposed to describe the organic removal in the presence of PAC in the activated sludge system, two mechanisms were responsible for the DNOC removal: biodegradation and carbon assumption. The main contribution to DNOC removal was adsorption. An expression was developed for DNOC to account for its removal in the AS-PAC process which was subject to a more realistic value of the adsorption capacity of the carbon. (Geiger-PTT)
W86-05136

PAC-ACTIVATED SLUDGE TREATMENT OF A STEEL MILL COKE-PLANT WASTEWATER,
China Steel Corp., Kaohsiung (Taiwan). Dept. of Research and Development.
Y. M. Chao, T. F. Yeh, and W. K. Shieh.
Journal of the Water Pollution Control Federation, Vol. 58, No. 4, p 333-338, April 1986, 8 fig, 3 tab, 26 ref.

Descriptors: *Activated carbon, *Activated sludge process, *Wastewater treatment, *Chemical oxygen demand, *Cyanide, *Separation techniques, Activated sludge, Industrial wastewater, Ammonia, Color, Organic compounds, Organic carbon, Nitrification, Nitrogen, Biodegradation, Biological wastewater treatment.

The efficacy of powdered activated carbon (PAC) addition for treatment of a coke-plant wastewater was evaluated in three completely mixed, continuous-flow activated sludge reactors with internal sludge recycle. Preliminary investigations were performed to select the PAC with the best removal of non-biodegradable organics, cyanide, and thiocyanate. Results showed that the treatment capacity of an existing conventional activated sludge process that treats coke-plant wastewater, with regard to chemical oxygen demand (COD), cyanide, and thiocyanate removal, was doubled with PAC addition to a mixed liquor PAC concentration of 300 mg/L. Adsorption of non-biodegradable organics by PAC seemed to be the main mechanism of improved COD removal in the PAC units. PAC addition stimulated the microbial oxidation of cyanide and thiocyanate in the activated sludge process. As a result, the effluent ammonia nitrogen concentration was higher than that originally contained in the feed when nitrification did not occur. A stoichiometric relationship existed between the amount of nitrogen released from the microbial oxidation of cyanide and thiocyanate and the incremental amount of ammonia nitrogen in the reactor effluent when nitrification was absent in the process. (Geiger-PTT)
W86-05137

PHOSPHORUS TRANSFORMATION IN A RAPID INFILTRATION COLUMN,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemical and Environmental Engineering.
D. R. Aulenbach, and M. Nie.
Northeastern Environmental Science, Vol. 4, No. 3-4, p 149-154, 1985. 7 fig, 3 tab, 9 ref.

Descriptors: *Phosphorous removal, *Wastewater treatment, *Trickling filters, *Sand filters, *Infiltration, Separation techniques, Phosphorous, Organic carbon, Filtration, Organic compounds, Chlorination, Biological wastewater treatment.

Little information is available concerning the mechanism of phosphorous removal from domestic wastewater in a rapid infiltration system consisting entirely of sand. The rapid infiltration systems of both Lake George Village and Bolton Landing consist entirely of sand with no clay present. Two columns were set up consisting of sand from the Lake George Sewer Plant. Trickling filter effluent from this plant was applied daily to a depth of 20 cm on one column. Samples were secured at approximately 60 cm depth intervals to 300 cm depth (the maximum depth of the column) and analyzed for total phosphorous, soluble P, organic P, and total organic carbon (TOC). After operation for two months, one column was sterilized using a strong chlorine dose. The treated wastewater applied was similarly treated to a high chlorine residual. Before sterilization, there was a significant production of organic P in the upper portion of the column. This disappeared completely after chlorination. Total P removal was slightly greater in the sterilized column. Some TOC removal was observed near the bottom of the column, indicating that complete sterilization was not achieved. The results indicate that phosphorous removal in a rapid infiltration system consisting entirely of sand is primarily a chemical reaction and is not enhanced by biological activity. (Geiger-PTT)
W86-05139

THERMAL REACTIVATION OF ACTIVATED CARBON WITH A TWO-STAGE FLUID BED REACTOR,
Stadtwerke Duesseldorf A.G. (Germany, F.R.).
W. Poggenburg, and J. Schubert.
Aqua AQUAAA, No. 2, p 69-71, 1986. 3 fig, 11 ref.

Descriptors: *Thermal reactivation, *Activated carbon, *Fluidized bed process, *Wastewater treatment, Fluidized bed process, Ozonation, Rhine River, West Germany, Dusseldorf.

The Stadtwerke Dusseldorf AG are treating Rhine River bank filtrate by ozone and activated carbon (65 million cu m/yr). 4,500 cu m, or about 1950 t of activated carbon have to be reactivated annually. Since 1976, a two-stage fluid bed reactor for thermal reactivation of activated carbon, with a capacity of 6 t/day, has been operated at the Dusseldorf-Holthausen waterworks. The on-site reactivation of activated carbon has been successful. Constant and satisfactory qualities of reactivated carbons are reached by continuous and automatic operation of the two-stage fluid bed reactor. Due to a high rate of utilization there are advantages in operation of the treatment plants and in the economy of reactivation. (Lantz-PTT)
W86-05144

REMOVAL OF AROMATIC NITRO-COMPOUNDS FROM WATER BY OZONATION,
Harbin Civil Engineering Inst. (China). Water Pollution Control Lab.
W. Baozhen, and Y. Jun.
Aqua AQUAAA, No. 2, p 86-93, 1986. 25 fig, 1 tab, 5 ref.

Descriptors: *Aromatic compounds, *Wastewater treatment, *Ozonation, Chemical analysis, Ultraviolet spectroscopy, Absorption, Benzene, Nitrotoluene, Nitroaniline, Nitrobenzene, Dinitrobenzene, Temperature effects, Chemical oxygen demand, Aromatic hydrocarbons.

Experimental studies were carried out on the removal of five species of aromatic nitro-hydrocarbons by ozonation. Ultraviolet spectrograms, with distinct absorption peaks, were graphed for them respectively. It was found that the absorbances of aqueous solutions containing single compounds mentioned above, increase to a different extent, at wavelengths ranging from 200 to 230 nm, with an increase of ozone dosage. This is ascribed to the nitrite ions splitting out of benzene rings and further oxidizing into nitrate ions by ozonation. It has been indicated that the removal of the five species of aromatic nitro-compounds by ozonation, can be expressed well mathematically, as a first order reaction equation. The reaction constants and half reduction periods for various species of tested nitro-compounds were calculated at different temperatures and pH. The ozonation effect index (OI) was developed in the study, as a method for expressing the degree of degradation of substrates by ozonation, by comparing the five aromatic nitro-hydrocarbons with each other, and finally ranking them in the following order, from greatest to smallest degrees of degradation: p-nitroaniline>nitrobenzene>p-dinitrobenzene>p-nitrotoluene> m-dinitrobenzene. It was also found that the chemical oxygen demand (COD) m/M ratio increases with ozone doses. This means that some easily degradable intermediates are produced and increase in concentration with the increase of ozone dose in the ozonation process. The mechanisms for removing the five aromatic nitr-hydrocarbons are discussed from the viewpoint of the orienting effect of substitute groups on the aromatic rings. (Lantz-PTT)
W86-05148

CHEMICAL AND BIOLOGICAL CHANGES IN MODEL PONDS SUPPLIED WITH POST-WASTE WATER: III. PLANKTON, PERIPHYTON, BENTHOS,
Instytut Ksztaltowania Srodowiska, Warsaw (Poland).
L. Klekot-Tourron.
Ekologia Polska, Vol. 32, No. 4, p 149-164, 1985. 5 fig, 4 tab, 25 ref.

Descriptors: *Plankton, *Self-purification, *Ponds, Periphyton, Zooplankton, Phytoplankton, Wastewater disposal, Municipal wastewater, Seasonal variation, Organic matter, Chemical oxygen demand, Copepods, Crustaceans, Poland.

Communities of phytoplankton, zooplankton, animal periphyton and of bottom fauna were studied in a channel carrying post-waste water to ponds, and in the ponds themselves from spring to autumn in 1977 at a municipal sewage-treatment plant at Pruszkow near Warsaw. Model transit-flow ponds were continuously supplied with post-waste water flowing out of sedimentation chambers with active sludge. Communities of organisms present in the ponds and in the channel carrying water, were studied with regard to their role in the self-purification process. In the water to be discharged into the ponds and in the ponds themselves a total of 58 phytoplankton species, 52 microzooplankton (Ciliata) and macrozooplankton (Rotatoria and Crustacea) species, 12 animal periphyton taxa, and 12 taxa of bottom fauna were found. Seasonal variations of plankton species could only be seen in the ponds that were most distant from the source of the post-waste water. A directly proportionate relationship was seen between the number of poly- and x-mesosaprobic species, and the amount of organic matter in the pond water, as measured by chemical oxygen demand and suspended organic matter. In the ponds that were closer to the source of water large numbers of individuals were found, whereas in the ponds more distant from the source there was a large number of species in all the communities studied. Only the community of the pond closest to the post-waste water source was satisfactory for efficient self-purification. In the remaining ponds the phytoplankton was too poor, and it proved technically difficult to remove the copepods and cladocerans that occurred there in large masses. (Peters-PTT)
W86-05196

CHARACTERIZATION OF AEROBIC AND FACULTATIVE ANAEROBIC BACTERIA FROM THE LIQUID PHASE OF AN ANAEROBIC FIXED-BED DIGESTER TREATING A CHEESE WHEY SUBSTRATE,
European Centre for Medium Range Weather Forecasts, Reading (England).
J. de Haast, and T. J. Britz.
Microbial Ecology MCBEBU, Vol. 12, No. 2, p 173-180, June 1986. 1 fig, 22 ref.

Descriptors: *Biological wastewater treatment, *Aerobic bacteria, *Anaerobic digestion, *Food-processing wastes, *Acetic acid, Anaerobic bacteria, Cheese, Whey, Enterobacter, Klebsiella, Citrobacter, Pseudomonas, Methane bacteria.

Efforts were made to isolate, enumerate, and perform a preliminary characterization of the predominant aerobic and facultative anaerobic bacteria from the liquid phase of a mesophilic anaerobic fixed-bed digester fed with a whey substrate. Average counts of bacteria of 16.6 x 1,000,000 and 26.5 x 1,000,000/ ml, were obtained on the two media, with the nutritionally poorer of the two giving the highest average count. Seventy-five isolates from both media, incubated aerobically and in anaerobic jars, were obtained. These isolates and 13 reference strains were phenotypically characterized. The organisms were clustered using the unweighted pair group method, and the results presented as a simplified dendrogram. The isolates could be divided into 3 main groups: gram-negative fermentative rods, mainly Enterobacter, Klebsiella, and Citrobacter, with Klebsiella as the predominant genus;

gram-positive bacteria, mainly enterococci; and gram-negative nonfermentive rods of the genera Pseudomonas, Alcaligenes, and Acinetobacter. All the enterobacteria and enterococci were able to produce acetic acid, an intermediate in methanogenesis. (Peters-PTT)
W86-05199

TURBIDITY REMOVAL FROM CLAY SUSPENSIONS BY USE OF ORGANIC POLYMERIC FLOCCULANTS,
Tokyo Inst. of Tech. (Japan). Dept. of Environmental Chemistry and Engineering.
S. Sakohara, H. Unno, and T. Akehata.
Journal of Chemical Engineering of Japan, Vol. 18, No. 4, p 331-336, August 1985. 11 fig, 3 tab, 9 ref.

Descriptors: *Turbidity removal, *Clay, *Organic compounds, *Wastewater treatment, Optical density, Flocculation, Turbidity, Suspended solids.

The removal of suspended substances from wastewater is one of the fundamental operations in water treatment. Turbidity removal from clay suspensions by use of organic polymeric flocculants was studied by relating the change in floc size, optical density through a flocculation tank and amount of flocculant absorbed onto suspended particles. A cylindrical vessel with six baffle plates was used to as a stirred tank. A six-blade flat turbine impeller was placed at the bottom. Floc size was observed photographically. Three sets of photometric measurement systems were installed on the tank to measure optical density. CdS photocells and a fluorescent lamp were used as photometric detectors and light source, respectively. The amount of flocculant adsorbed was calculated from the difference in amounts between injected and residual flocculant. Turbidity removal is represented by taking two regimes into consideration, i.e., the earlier period, appearing just after flocculant injection, when the flocculant adsorption rate controls the process, and the later period when a limited number of flocs named 'mother flocs' control the process. The turbidity removal rates in both regimes were evaluated easily from the modified optical density variation proposed in this work and represented by two different first-order processes with respect to the modified optical density. The rate constants in both regimes were related linearly to each other, and its proportional constant depended on the condition of agitation. (Main-PTT)
W86-05260

WATER CONTENT AND ELECTRIC POTENTIAL DISTRIBUTIONS IN GELATINOUS BENTONITE SLUDGE WITH ELECTOOSMOTIC DEWATERING,
Oyama National Coll. of Technology (Japan). Dept. of Industrial Chemistry.
H. Yoshida, T. Shinkawa, and H. Yukawa.
Journal of Chemical Engineering of Japan, Vol. 18, No. 4, p 337-342, August 1985. 14 fig, 4 ref.

Descriptors: *Electrical potential distributions, *Sludge drying, *Electroosmosis, *Dewatering, Wastewater treatment, Electric currents.

To analyze the electroosmotic dewatering process precisely, the variations of water content and electric potential distributions in the sludge are made clear. The distributions of water content and electric potential in gelatinous bentonite sludge with electroosmotic dewatering were studied experimentally under the conditions of both constant voltage and constant electric current. It is proved that the water content distribution is generally related to the electric potential distribution throughout the dewatering process. Electroosmotic dewatering under constant voltage is compared with that under constant electric current. Large voltage (E sub o) is not necessarily effective for dewatering throughout the sludge bed, as described previously. Electroosmotic dewatering combined with vacuum dewatering is also discussed and was found to be effective for dewatering throughout the sludge bed. (Main-PTT)
W86-05261

SOME RHEOLOGICAL FEATURES OF CONCENTRATED EXCESS ACTIVATED SLUDGE OF THIXOTROPIC NATURE,
Tokyo Inst. of Tech. (Japan). Dept. of Environmental Chemistry and Engineering.
H. Unno and, and T. Akehata.
Journal of Chemical Engineering of Japan, Vol. 18, No. 6, p 533-538, December 1985. 13 fig, 9 ref.

Descriptors: *Activated sludge, *Sludge excess, Organic matter, Sludge drying, Shear stress, Physical properties, Wastewater.

The flow behavior of excess activated sludge containing highly concentrated organic solids, and showing an extremely thixotropic nature, was investigated. The apparatus for rheological measurement was a rheometer equipped with a concentric cylindrical cell. The shear stress measurement was made at a constant shear rate which changed stepwise. The sludge was sampled from the tank of a wastewater treatment plant. The sampled sludge was screened and thickened centrifugally. The solid content was determined by filtering and drying within an air bath. By applying this method the relationship between shear rate and shear stress of structure sludge was obtained, and it was found that the relationship was very similar to that of a plastic fluid. The relationship was named the sludge structure curve (SSC). SSC was degenerated into one curve by using a yield stress which was characteristic of each structure. This curve was named the sludge characteristic curve (SCC), because SCC was uniquely determined by the concentration of solid and sludge conditioning agent, independently of sludge structure and temperature. (Main-PTT)
W86-05262

APPLICATION OF THE UPFLOW ANAEROBIC SLUDGE BED (UASB) PROCESS FOR TREATMENT OF COMPLEX WASTEWATERS AT LOW TEMPERATURES,
Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control.
I. W. Koster and, and G. Lettinga.
Biotechnology and Bioengineering, Vol. 27, No. 10, p 1411-1417, October 1985. 8 fig, 3 tab, 26 ref.

Descriptors: *Anaerobic digestion, *Upflow anaerobic sludge bed, Thermal effects, Wastewater treatment, Sludge, Chemical oxygen demand.

With the recently introduced modern anaerobic wastewater treatment processes such as the upflow anaerobic sludge bed (UASB) process the main bottleneck in the full-scale application of anaerobic wastewater treatment seems to be solved for a large variety of liquid wastes. The feasibility of the UASB process for the treatment of potato starch wastewater at low ambient temperatures was demonstrated by operating two 5.65-L reactors at 14 C and 20 C, respectively. The organic space loading rates achieved in these laboratory-scale reactors were 3 kg COD/cu m/day at 14 C and 4-5 kg COD/cu m/day at 20 C. The corresponding sludge loading rates were 0.12 kg COD/kg VSS/day at 14C and 0.16-0.18 COD/kg VSS/day at 20C. These findings are of considerable practical importance because application of anerobic treatment at low ambient temperatures will lead to considerable savings in energy needed for operating the process. As compared with various other anerobic wastewater treatment processes, a granular sludge upflow process represents one of the best options developed so far. (Main-PTT)
W86-05263

OZONE AND ACTIVATED CARBON FOR TERTIARY WASTEWATER TREATMENT,
Texas Univ. at Dallas, Richardson.
A. Netzer, J. L. McNutt, and R. P. Smith.
Ozone Science & Engineering, Vol. 7, No. 1, p 1-10, Winter, 1985. 5 tab, 8 ref.

Descriptors: *Ozone, *Activated carbon, *Wastewater treatment, Oxygenation, Ozonation, Garland, Texas.

Preozonation of biologically or physically-chemically treated wastewater effluents, followed by passage through granular activated carbon (GAC) for tertiary wastewater treatment was studied at the Duck Creek Wastewater Treatment in Garland, Texas. Whereas the average period of operation for the GAC before exhaustion without ozone pretreatment was 70 days, pretreatment with ozone or with oxygen alone extended GAC operation to at least 480 days, without exhaustion. Effluent streams consistently met applicable discharge standards during this period of time, without the necessity of regenerating the GAC. (Author's abstract)
W86-05269

CATALYTIC EFFECTS OF ULTRAVIOLET LIGHT AND/OR ULTRASOUND ON THE OZONE OXIDATION OF HUMIC ACID AND TRIHALOMETHANE PRECURSORS,
Arizona Univ., Tucson. Dept. of Civil Engineering and Engineering Mechanics.
R. A. Sierka and, and G. L. Amy.
Ozone Science & Engineering, Vol. 7, No. 1, p 47-62, Winter, 1985. 2 fig, 8 tab, 25 ref.

Descriptors: *Ozonation, *Humic acid, *Trihalomethane, *Ultrasonics, *Ultaviolet light, Wastewater treatment, Alkalinity, Total organic carbon.

Humic substances represent the most important group of trihalomethane (THM) precursors and account for roughly 50% of the dissolved organic carbon in surface waters. Ozone has been used for THM precursor destruction. This paper describes the singular and composite effects of two catalysts; ultraviolet (UV) light and ultrasound (US) on the ozone (O sub 3) oxidation of a purified solution of a commercially available humic acid with the objective of minimizing THM formation potential (THMFP). The principal findings are that: (1) the most effective reactor conditions for both the destruction of nonvolatile total organic carbon (NVTOV) and THMFP utilized both US and UV in combination with ozone, and (2) bicarbonate alkalinity reduces the oxidation efficiency of the US-UV-O sub 3 system apparently as a consequence of radical scavenging. (Main-PTT)
W86-05270

PRINCIPLES OF OZONE OXIDATION AND DISINFECTION DESIGN,
Societe Degremont, Rueil-Malmaison (France).
Y. Richard.
Ozone Science & Engineering, Vol. 7, p 63-76, 1985. 11 fig, 19 ref.

Descriptors: *Ozonation, *Disinfection, *Water treatment, *Design standards, Wastewater treatment, Deep-U-Tube contactor.

The efficiency of ozone for different purposes can be determined by different laboratory tests. It is necessary to use a specific test for each aim of ozonation. The two methods for studying the removal of pollutants in the laboratory, the flask method and column method, are discussed as are apparatuses used for the inactivation of viruses. Over the past few years, two systems have been used in the application of ozone in treatment lines, a single contact chamber and a two chamber contact system. It is absolutely necessary to use a two chamber contact system for the application of ozone as a virucide. Various operational systems and their efficiencies were investigated. The design of commercial ozone-water contact systems can be determined in relation with the purpose of ozonation; virucide effect, oxidation of pollutant, clarification improvement or wastewater disinfection. The system of successive contact columns seems to be the best adapted to achieve the virucidal effect recommended by hygiene specialists, and the techniques required for reliable monitoring of this technique are now available. (Main-PTT).)
W86-05271

CONTROL OF A FULLY AUTOMATED OZONE APPLICATION SYSTEM,
Harkin Environmental Systems, Inc., Montreal (Quebec).
D. R. MacKay.

Ozone Science & Engineering, Vol. 7, p 77-84, 1985. 5 fig.

Descriptors: *Ozonation, *Automation, Computers, Computer programs, Optimization, Pont Viau, Quebec, Water treatment facilities.

A fully automated system at Pont Viau, Quebec is controlling a two-stage ozonation system treating 140 x 10 to the 3rd power cu m/h of potable water in a full-scale water treatment plant. This plant presented problems with respect to implementation of automatic dosage control. The solution, used at Pont Viau, to this dilemma was to implement an intelligent control system which determines the total ozone requirement for the three contactors, selects the optimum equipment configuration to produce that much ozone, and delivers the appropriate quantity of ozone to each contactor. The highest level of control is the supervisory computer which has a data communications path to each of six ozone generators and a direct link to the ozone destruct system. The intermediate level of control is provided by microprocessor-based programmable controllers associated with each of the ozone generators, and the lowest level of control is the manual override. The optimization algorithm of the system is designed to minimize system power consumption and equalize equipment runtimes. This optimization scheme makes it possible to achieve a step-like power consumption curve for the total system. Total ozone requirement is calculated, the most power-efficient equipment configuration is selected, and the flow of ozone to each contractor is controlled. In addition, graphic display of equipment status and process variables is provided, system events are logged, and strip charts and reports are produced. A supervisory computer with control capabilities can achieve significant energy savings in an ozone generation system comprised of several trains of equipment. At the same time, maximum flexibility of equipment utilization can be achieved along with complex dosage control. (Main-PTT)
W86-05272

TREATMENT EFFICIENCY OF AN IMPROVED OZONATION UNIT APPLIED TO FISH CULTURE SITUATIONS,
Biologische Anstalt Helgoland (Germany, F.R.)
For primary bibliographic entry see Field 5F.
W86-05273

POWERED ACTIVATED CARBON AND OZONE-ASSISTED ACTIVATED SLUDGE TREATMENT FOR REMOVAL OF TOXIC ORGANIC COMPOUNDS,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
E. L. Stover, A. Fazel, and D. F. Kincannon.
Ozone Science and Engineering, Vol. 7,No. 3, p 191-203, Summer 1985. 2 fig, 6 tab, 12 ref.

Descriptors: *Activated carbon, *Ozonation, *Activated sludge, *Organic compounds, Wastewater treatment, Acrylonitrile, 2,4-dinitrophenol, 1,2-dichloropropane, Pretreatment of water.

Industrial wastewater effluent standards in the United States are being established in terms of both conventional parameters like BOD and specific organic compounds called priority pollutants. Wastewater treatment processes must be designed based on achieving the conventional parameters and specific chemical limitations. Some compounds are difficult to treat biologically and the removal mechanisms may include biodegradation, stripping, sorption, or combinations of these mechanisms. The treatability and fate of specific organic compounds during treatment by complete-mix activated sludge systems is addressed. Bench-scale, continuous flow, complete-mix activated sludge reactors were used for all investigations. The compounds investigated were acrylonitrile, 2,4-dinitrophenol, and 1,2-dichloropropane. Data from controlled activated sludge systems, systems receiving powdered activated carbon, and systems with preozonation assist are included. The constituents in a particular wastewater will determine whether biological treatment assists such as activated carbon or preozonation can significantly enhance the treatment or removal of those compounds. Activated carbon and ozone are not necessarily 'cure alls' for difficult to biodegrade organic compounds and should not be applied indiscriminately. (Main-PTT)
W86-05274

TREATMENT OF AN IN-SITU OIL-SHALE RETORT WATER,
University of Wyoming Research Corp., Laramie. Western Research Inst.
For primary bibliographic entry see Field 5F.
W86-05285

NEW APPROACH TO IN-SITU TREATMENT OF CONTAMINATED GROUNDWATERS,
Underground Resource Management, Inc., Austin, TX.
For primary bibliographic entry see Field 5G.
W86-05286

LIMITATIONS OF SLUDGE FILTRATION THEORY AT CONSTANT VACUUM PRESSURE,
Nigeria Univ., Nsukka. Dept. of Civil Engineering.
J. O. Ademiluyi.
Effluent and Water Treatment Journal, Vol. 26, No. 1, p 19-22, January 1986. 1 fig, 28 ref.

Descriptors: *Filtration, *Wastewater treatment, *Sludge filters, Vacuum filtration, Theoretical analysis, Mathematical studies, Mathematical equations.

A brief development of the sludge filtration theory proposed in recent years is presented and the limitations of this theory are highlighted. The concepts of specific resistance, Carman's equations, and filtration theory are outlined. After a review of both Poiseuille's and D'Arcy's laws, it is concluded that an acceptable equation which governs the filtration process has not been derived. Such an equation must contain the compressibility coefficient and this coefficient must be clearly defined and should agree with the theory throughout the range of dilutions. Also the equation must not include the area A of filter bed since the effective area to be used, cannot be easily evaluated. Above all, the equation must be useful in the laboratory evaluation of specific resistance. (Master-PTT)
W86-05287

NEUTRALIZATION OF WASTEWATERS CONTAINING CYANIDES; PART II: ELIMINATION BY CHEMICAL OXIDATION IN SOLUTION,
Marie Curie-Sklodowska Univ., Lublin (Poland). Dept. of Environmental Chemistry and Technology.
R. Gierzatowicz, L. Pawlowski, and E. Smulkowska.
Effluent and Water Treatment Journal, Vol. 26, No. 1, p 26-31, January 1986. 3 fig, 1 tab, 13 ref.

Descriptors: *Neutralization, *Wastewater treatment, *Wastewater *management, *Cyanide, *Oxidation, Decomposition, Potassium permangenate, Potassium chromate, Hydrogen ion concentration.

The classic method of cyanide oxidation with chlorine or, more often with hypochlorite, is described. Nine intermediate reactions between the oxidizing agent and cyanides are detailed. Two flowsheets of cyanoalkaline wastes decomposition installations, one for a continuous system and the other for a batch system, are discussed in terms of function and in terms of the cost of cyanide decomposition process per 1 kg CN. The agents which cause cyanide waste decomposition include: peroxy compounds (such as hydrogen peroxide, Caro's acid, peracetic acid, potassium persulfate, perborates, percarbonates and organic peroxides), and potassium permanganate or potassium chromate. The chemical reactions involved are described and the respective equations are given. The efficiency of each process is related to the pH range and the influence of waste reaction on oxidation is discussed. (Master-PTT).)
W86-05289

WASTEWATER TREATMENT USING AQUATIC PLANTS. SURVIVABILITY AND GROWTH OF SALVINIA MOLESTA (MITCHELL) OVER WATERS TREATED WITH ZINC (II) AND THE SUBSEQUENT UTILIZATION OF THE HARVESTED WEEDS FOR ENERGY (BIOGAS) PRODUCTION,
Centre for Water Resources Development and Management, Kunnamangalam (India).
S. A. Abbasi, and P. C. Nipaney.
Resources and Conservation, Vol. 12, No. 1, p 47-55, August 1985. 2 fig, 4 tab, 29 ref.

Descriptors: *Wastewater treatment, *Aquatic plants, *Zinc, Salvinia molesta, Biogas, Well water, Energy sources.

Utilization of the weed Salvinia molesta, which is very common in several parts of the world, would compensate for the cost of its mechanical removal. The potential of the weed in treating wastewaters containing zinc(II), and the subsequent conversion of the harvested weed into energy, have been explored with the end-objective of developing an energy-saving water pollution control system, with respect to zinc(II). Filtered well water was used for the growth study. Standard tests failed to detect zinc in the well water. Healthy Salvinia plants of free-floating growth stage were collected, acclimated, and treated with zinc solution. The average gas yield from uncatalyzed Salvinia was 30.4 L/kg (fresh weight of Salvinia). The 35-day average yield in presence of zinc(II) works out to be 40.3 L/kg (fresh weight) of Salvinia. There was a 33% enhancement in yield in the presence of zinc(II). It appears that zinc causes a stimulation in the growth of cellulolytic and methanogenic bacteria at trace levels, and also catalyzes some of the biochemical reactions involving electron transfer. (Master-PTT)
W86-05294

EVALUATION OF THE WATER SUPPLY AND SANITATION PROBLEMS IN NIGERIA,
Ibadan Univ. (Nigeria). Coll. of Medicine.
For primary bibliographic entry see Field 5F.
W86-05300

MERSEY ESTUARY POLLUTION ALLEVIATION SCHEME,
North West Water Authority, Warrington (England).
A. Dixon.
Institution of Water Engineers and Scientists Journal, Vol. 39, No. 5, p 401-413, October 1985. 5 fig, 1 tab, 4 ref.

Descriptors: *Mersey estuary, *Pollution, *Water pollution control, Water quality, Wastewater, Regional planning, England, Effluents, Odor control, Industrial wastewater.

The Mersey Estuary receives surface drainage (4535 sq km), sewage, and trade waste flows from the catchments of the Mersey and Weaver Rivers. The area is highly urbanized and industrialized with a total population of 5 million. The estuary is 50 km long with poor or bad water quality resulting from crude sewage, strong trade effluents, partially treated sewage, and polluting fresh water inputs. The North West Water Authority was formed in 1974 and has developed a plan to significantly improve estuary water quality by 1995-96. The water quality objectives for the estuary were stated as: 1) the estuary should at all times contain dissolved oxygen in order to obviate odor nuisance; and, 2) the foreshore and beaches should not be subject to fouling by crude sewage or solids or fats from industrial effluents. (Lantz-PTT)
W86-05304

'UASB' PROCESS FOR DOMESTIC WASTEWATER TREATMENT IN DEVELOPING COUNTRIES,
Haskoning B.V., Nijmegen (Netherlands).
J. L. Kooijmans, G. Lettinga, and G. Rodriguez Parra.
Institution of Water Engineers and Scientists Journal, Vol. 39, No. 5, p 437-451, October 1985. 9 fig, 11 ref.

Descriptors: *Domestic wastewater, *Wastewater treatment, *Developing countries, Tropical regions, Agrarian wastes, Cali, Colombia, Anaerobic treatment, Sludge digestion.

Application of conventional, advanced wastewater treatment technologies are not economically feasible in developing countries due to high investment and operating costs and the lack of skilled staff for operation and maintenance. One new technology, which has a lower operating cost, and easier maintenance and operation standards, is the Upflow Anaerobic Sludge Blanket (UASB), which was developed some 12 years ago at the Agricultural University of Wageningen, in the Netherlands, as a pre-treatment of medium and high strength agro-industrial wastes (in terms of COD), mainly of agrarian origin. Since the optimum process temperatures are in the range of 30-40 C, the anaerobic process was not considered to be feasible for treatment of low strength domestic sewage, particularly not under climatological conditions where the temperature may drop to 8-10 C or even lower. This paper gives a short description of the UASB process and its characteristics, and of the pilot plant research performed in Cali, Columbia, and the main results obtained so far. The first phase of the project, which also included some post-treatment research, was terminated at the end of 1984, but the research will be continued. In the second phase emphasis will be put on the treatment of combined domestic-industrial flows, upscaling, and reuse of the effluent for irrigation after post-industrial flows, upscaling, and reuse of the effluent for irrigation after post-treatment and sludge disposal. (Lantz-PTT)
W86-05305

ORGANIC LOADING STUDY OF FULL-SCALE SEQUENCING BATCH REACTORS,

Notre Dame Univ., IN. Dept. of Civil Engineering.
R. L. Irvine, L. H. Ketchum, Jr., M. L. Arora, and E. F. Barth.
Water Pollution Control Federation Journal, Vol. 57, No. 8, p 847-853, August 1985. 1 fig, 11 tables, 16 ref.

Descriptors: *Sequencing batch reactors, *Organic loading, *Wastewater treatment, Phosphorus, Flow rate, Energy Use, Biochemical oxygen demand, Sludge disposal, Sludge digestion.

Sequencing batch reactors are a time-oriented activated sludge system shown in full scale to be capable of achieving biochemical oxygen demand, suspended solids and nitrogen removal, biological phosphorus removal, and the treatment of hazardous waste. Test data are presented for both low and high organic loading. The SBR demonstrated high treatment performance for biological oxygen demand (BOD) and suspended sediment (SS) removal. Effluent limits of 10 mg/L BOD and SS were easily attainable and biological phosphorus removal was readily achieved. A wide range of operating potential was also demonstrated by showing similar performance from two parallel SBRs: one with a sludge age of 9.5 days, a yield of 0.82 kg sludge wasted/kg BOD applied, and an organic loading of 0.42 kg BD/kg mixed liquid volatile suspended solids (MLVSS)/d on an aeration time adjusted basis; and the other with a sludge age of 38 days, a yield of 0.56 kg/kg and a corresponding loading of 0.16 kg BOD/kg MLVSS/d. Aeration energy use in kWh/kg BOD applied ranged over a wide spectrum; 60% more energy was needed per kilogram BOD applied in the North SBR than the South SBR. However, the kilowatthours needed for each kilogram BOD actually oxidized (not carried off with the waste sludge) was quite similar; 6.0 kWh/kg BOD oxidized was needed for the North SBR, and 6.7 kWh/kg was needed for the South SBR. Two major conclusions can be drawn from this study. First, effluent quality from both SBRs was excellent. Second, energy use in the more highly loaded system was about 30% less than that for the system with lower loading, based on kilogram BOD, applied. (Lantz-PTT)
W86-05308

TECHNOLOGY EVALUATION OF SEQUENCING BATCH REACTORS,

Montgomery (James M.), Inc., Pasadena, CA.
M. L. Arora, E. F. Barth, and M. B. Umphres.
Water Pollution Control Federation Journal, Vol. 57, No. 8, p 867-875, August 1985. 3 fig, 2 tab, 20 ref. EPA Contract No. 68-02-1821.

Descriptors: *Sequencing batch reactors, *Evaluations, *Wastewater treatment, Activated sludge, Design standards, Operating policies, Wastewater facilities.

One beneficial innovative and alternative wastewater treatment technology is the sequencing batch reactor (SBR). The major obstacle to bringing SBR technology from the research stage to broader practical application is a lack of widely accepted design standards. The results of a post-construction evaluation of 8 facilities indicate that all plants are producing effluent of acceptable quality. Different carbon, nitrogen, and phosphorus removals are achieved by changes in operating strategy. All operators report that SBR is easier to operate than conventional continuous-flow systems. All U.S. plants have experienced problems with decanter mechanisms. (McFarlane-PTT)
W86-05309

USING ATP TO DETERMINE THE CHLORINE RESISTANCE OF FILAMENTOUS BACTERIA ASSOCIATED WITH ACTIVATED SLUDGE BULKING,

California Univ., Berkeley. Dept. of Civil Engineering.
J. B. Neethling, K. M. Johnson, and D. Jenkins.
Water Pollution Control Federation Journal, Vol. 57, No. 8, p 890-894, August 1985. 7 fig, 1 tab, 32 ref. NSF Grant No. CME-8006295.

Descriptors: *Adenosine triphosphate, *Chlorine resistance, *Filamentous bacteria, *Activated sludge, *Bulking, Bioluminescence, Microbiological studies, Chlorine, Disinfection, Dissolved oxygen.

Activated sludge bulking is caused by the uncontrolled growth of filamentous microorganisms in activated sludge, and controlled by doses of chlorine. Standard enumeration techniques cannot be used with organisms growing in flocs, so ATP concentration was used in this study, using a new luciferin/luciferase method. The observed effects of a disinfectants on microorganisms depends on enumerative techniques. In this study, plate counting was more sensitive than ATP measurement. The filaments associated with low food-to-microorganism (F/M) bulking showed more resistance to monochloramine than those associated with low dissolved oxygen bulking. Thus higher chlorine doses may be needed to control low F/M bulking. (McFarlane-PTT)
W86-05310

CHEMICAL QUALITY OF PERCHED SEPTIC TANK EFFLUENT FOR PLANT USE AND RECHARGE,

Agricultural Research Service, Fresno, CA. Water Management Research Lab.
H. I. Nightingale, and R. L. McCormick.
Water Pollution Control Federation Journal, Vol. 57, No. 9, p 916-920, September 1985. 4 fig, 4 tab, 27 ref.

Descriptors: *Water quality, *Septic tank effluent, *Water reuse, *Water recharge, Nitrates, Fertilizers, Irrigation, Leach field, Well water, Chlorides, Chemical analysis.

Abstract: Septic tank and soil absorption systems have a significant role in onsite domestic waste disposal strategies but their impact on groundwater quality is variable. A new rural, residential home with onsite domestic water well, septic tanks, and leach lines was studied. After 3 years, the mean NO3(-)-N in the perched water was 1.2, 27.6, and 30.1 mg/l at 0.5, 3.5, and 6.5 m, respectively from the leach lines. Measurements for perched water elevations within the leach field indicated that the recharge mound stayed within the lot boundaries; thus, slow percolation of the perched water through the restricting sublayer was occurring. Soil sampling from the 80- to 140-cm root zone at three sampling sites within the leach field showed a 333% increase in soil NO3(-)-N (1.2 to 5.2 mg/kg) and a 156% increase in CL(-) (4.0 to 10.3 mg/kg) during the 3-year period. Once front yard vegetation has been planted and develops, the NO3(-) and perched water could be used to reduce the requirement for both nitrogen-fertilization and supplmemental irrigation (Lantz-PTT)
W86-05311

BIOASSAY SYSTEM FOR INDUSTRIAL CHEMICAL EFFECTS ON THE WASTE TREATMENT PROCESS: PCB INTERACTIONS,

T. Vitkus, P. E. Gaffney, and E. P. Lewis.
Water Pollution Control Federation Journal, Vol. 57, No. 9, p 935-941, September 1985, 2 fig, 8 tab, 25 ref.

Descriptors: *Bioassay, *Industrial chemicals, *Chemical effects, *Waste treatment, *Polychlorinated biphenyls, Biomonitoring, Toxicity, Arochlor 1254, Biological oxygen demand, Chemical oxygen demand.

This research presents the results of an investigation using a lab-scale, fixed-film biomass to evaluate the long-term effects of continuous exposure to polychlorinated biphenyls (PCB). The investigation was stimulated by the discovery of PCB in a municipal waste treatment facility influent in conjunction with an operation record that exhibited very poor biochemical oxygen demand (BOD) removal during secondary treatment (trickling filters). Results concluded that: 1) The lab-scale waste treatment model developed was an efficient for wastewater treatment and for evaluating effects of an industrial chemical on these processes; 2) The chronic and acute exposures to Aroclor 1254, from 1 to 1000 microgram/L and 2000 to 200 000 micrograms/L, respectively, did not alter waste treatment efficiency, nor did the Aroclor doses result in any visible manifestations of toxicity to the biomass; 3) There was no evidence of biodegradation of Aroclor 1254; 4) The biomass accumulated an estimated Aroclor 6,200,000 micrograms/kg (dry weight) during the study; and 5) Volatility of Aroclor 1254 most likely accounted for the 30 to 39% loss of PCB administered to the model system. (Lantz-PTT)
W86-05312

COOLING TOWER EVAPORATION OF TREATED COAL GASIFICATION WASTEWATERS,

Pittsburgh Univ., PA. School of Engineering.
R. D. Neufeld, M. R. Debes, C. Moretti, J. Mayernik, and G. Keleti.
Water Pollution Control Federation Journal, Vol. 57, No. 9, p 955-964, September 1985. 3 fig, 11 tab, 16 ref. DOE Contract No. DE-AC18-81FC10299.

Descriptors: *Cooling tower, *Coal gasification, *Wastewater treatment, Biological pretreatment, Polycyclic aromatic hydrocarbons, Blowdown water, Daphnia, Bioaccumulation, Organic compounds, Water pollution effects, Bioindicators, Toxicity.

The objective of this study was to characterize cooling tower makeup, blowdown, evaporate, and drift when fixed-bed North Dakota lignite coal gasification wastewaters were pretreated with solvent extraction, free ammonia stirring, and aerobic biological processing. There were tendencies for calcium carbonate deposition and chemical corrosion, under-deposit corrosion potentials, and severe foaming in cooling tower recirculation waters. Foaming was reduced by aerobic biological processing. Significant quantities of ammonia, phenolics, and total organic carbon were lost selectively to the atmosphere from the cooling tower. Water, air and ash samples yielded mostly negative Ames tests. Biological pre-treatment had little effect on blowdown toxicity but did remove organic compounds from makeup waters. Bioaccumulative polycyclic aromatic compounds were found in makeup and blowdown waters thus air pollution potential exists from this cooling tower source. (McFarlane-PTT)

W86-05313

SELECTING EFFECTIVE SOFTWARE FOR WATER AND WASTEWATER TREATMENT FACILITIES,
Engineering-Science, Inc., Atlanta, GA.
M. R. D'Alessandro.
Public Works, Vol. 117, No. 2, p 42-44, February 1986.

Descriptors: *Computers, *Wastewater treatment, *Training, Management planning, Computer programs, Automation, Process control, Water treatment.

This article focuses on the implementation of computer hardware and software to get the operator of a wastewater or water treatment plant to use computers to streamline operation, maintenance, and management procedures to enhance process performance and reduce the hours required for various tasks. During system design, it is necessary to recognize those aspects of treatment management that are improvable by use of a computer. Three treatment operational areas that are well suited for implementation of a microcomputer are data management and evaluation, process control, and total maintenance. User considerations to look for in the computer software system include key-trapping, error-trapping, and program movement features. Implementation considerations should also be accounted for at the time of software and hardware installation. Installation plans should include a well-designed training program that features an initial review of the operating manual, classroom instruction for review of system capabilities, hands-on training with actual microcomputer operation, review of system security for managers, and hands-on training of managers for system utilities such as data file management. (Geiger-PTT)
W86-05319

DISTRIBUTION OF RETENTION TIMES IN MODEL BIOLOGICAL FILTERS CONTAINING PACKED SPHERES,
Technical Univ. of Istanbul (Turkey). Dept. of Environmental Engineering.
Y. Muslu.
Water Research, Vol. 20, No. 3, p 259-265, March 1986. 5 fig, 1 tab, 25 ref.

Descriptors: *Wastewater treatment, *Models, *Biological filters, *Retention time, *Trickling filters, *Theoretical analysis, Flow velocity, Flow rates, Mathematical models, Mathematical studies, Packed beds.

A major element of substrate utilization in biological filters is the liquid retention time. Biological efficiency is influenced by retention time rather than the form of the C-curves (flow-through curves). A theory developed for computing flow time using the velocity equation of the laminar regime was experimentally verified and the ranges of validity of dispersed plug flow and mixed flow were determined to compute the retention time. Mean residence time when plotted vs. hydraulic loading on a log-log paper provides straight lines. To reach this result, the hydraulics of falling films and jets was used. (Geiger-PTT)
W86-05329

FEEDFORWARD CONTROL OF A WASTEWATER PLANT,
Queensland Univ., Brisbane (Australia). Dept. of Chemical Engineering.
G. D. Corder, and P. L. Lee.
Water Research, Vol. 20, No. 3 p 301-309, March 1986. 14 fig, 1 tab, 16 ref.

Descriptors: *Wastewater treatment, *Process control, *Activated sludge process, *Models, *Aeration, *Dissolved oxygen, Aeration tanks, Wastewater facilities, Simulation analysis, Spectral analysis, Cost analysis, Mathematical models, Oxygen demand.

A feedforward control strategy to compensate for disturbances in the applied biological load to the activated sludge plant was designed. This strategy was generated from Laplace-domain transfer function models predicting the dissolved oxygen concentration at the end of the aeration tank from the applied biological load and the air flowrate. In producing these models, the Luggage Point Wastewater Treatment Plant was used to obtain plant data. After conducting a series of computer simulation tests, the improvement in performance using the new control scheme compared to the existing dissolved oxygen feedback controller resulted in a 20% reduction in air flowrate. It is estimated the new strategy would give a payback period of less than 15 months. (Author's abstract)
W86-05335

ROLE OF AQUATIC PLANTS IN WASTEWATER TREATMENT BY ARTIFICIAL WETLANDS,
San Diego Water Reclamation Agency, Santee, CA.
R. M. Gersberg, B. V. Elkins, S. R. Lyon, and C. R. Goldman.
Water Research, Vol. 20, No. 3, p 363-368, March 1986. 3 fig, 2 tab, 23 ref. CA Dept. of Water Resources grant B-53459 AM IV and EPA grant CR-807299-03-0.

Descriptors: *Aquatic plants, *Wastewater treatment, *Wetlands, *Nitrogen removal, *Denitrification, Ammonia, Biochemical oxygen demand, Suspended solids, Nitrification, Bulrushes, Cattails, Root zone, Rhizosphere, Advanced wastewater treatment.

This report describes studies using artificial wetlands which quantitatively assess the role of each of three higher aquatic plant types (bulrush, common reed, and cattail) in the removal of nitrogen (via sequential nitrification-denitrification), BOD and total suspended solids (TSS) from primary municipal wastewaters. During the period August 1983-December 1984, the mean ammonia concentration of 24.7 mg/liter in the primary wastewater inflow (hydraulic application rate = 4.7 cm/day) was reduced to mean effluent levels of 1.4 mg/liter for the bulrush bed, 5.3 mg/liter for the reed bed and 17.7 mg/liter for the cattail bed. For all three vegetated beds, the mean effluent ammonia values were significantly below that for the unvegetated control bed and for the inflow. The bulrushes and reeds proved to be superior at removing ammonia, both with mean effluent levels significantly below that for the cattail bed. The high ammonia-N and total N removal efficiencies of the bulrush and reed beds are attributed to the ability of these plants to translocate oxygen from shoots to roots, which in turn stimulates sequential nitrification-denitrification. BOD removal efficiencies were also highest in the bulrush and reed beds. These findings suggest that higher aquatic plants can play a significant role in secondary and advanced wastewater treatment by wetland systems. (Geiger-PTT)
W86-05342

EFFECT OF TRACER DIFFUSION IN BIOFILM ON RESIDENCE TIME DISTRIBUTIONS,
Cincinnati Univ., OH. Dept. of Civil and Environmental Engineering.
D. K. Stevens, P. M. Berthouex, and T. W. Chapman.
Water Research, Vol. 20, No. 3, p 369-375, March 1986. 6 fig, 3 tab, 8 ref.

Descriptors: *Tracers, *Wastewater treatment, *Dye releases, *Dyes, *Biofilters, *Biological membranes, *Fluidized beds, Error analysis, Models, Mixing, Diffusion coefficient, Temporal distribution.

Estimating fixed-film biological reactor characteristics is often complicated by interaction of the tracer that is used in residence time distribution (RTD) studies with the biofilm in a way that causes the RTD curve to have a long tail. This tail can result from hold-up of tracer within the biofilm. A reactor model that ignores the diffusion rate at which tracer enters and leaves the biofilm may be seriously in error. Data from RTD studies in a fluidized bed reactor are presented and a model that accounts for diffusion of tracer in the biofilm is used to explain the experimental data. A material balance on inorganic nitrogen is also given to verify the organic dye tracer results. The conditions under which diffusion of tracer will cause large distortions are defined. (Author's abstract)
W86-05343

ALGAE REMOVAL BY FINE SAND/SILT FILTRATION,
Louisiana Dept. of Transportation and Development, Baton Rouge.
For primary bibliographic entry see Field 5F.
W86-05344

METHANOGENIC DIGESTION USING MIXED SUBSTRATE OF ACETIC, PROPIONIC AND BUTYRIC ACIDS,
Tohoku Univ., Sendai (Japan). Dept. of Civil Engineering.
Ch.-Y. Lin, K. Sato, T. Noike, and J. Matsumoto.
Water Research, Vol. 20, No. 3, p 385-394, March 1986. 10 fig, 4 tab, 33 ref.

Descriptors: *Wastewater treatment, *Anaerobic digestion, *Biological wastewater treatment, *Organic acids, *Methane, *Retention time, Methane bacteria, Digestion, Organic compounds, Acetic acid, Butane, Propane, Chemical oxygen demand, Anaerobic conditions, Performance evaluation.

Experiments on methanogenic digestion using high concentrations of mixed substrates were conducted. The major intermediate products of anaerobic digestion such as acetic, propionic and butyric acids were mixed in a ratio of 2:1:1 (COD basis), respectively, and used as a substrate for feeding into continuous-flow chemostat reactors maintained at 35 degrees. These reactors were operated stably at higher feed substrate concentrations and shorter hydraulic retention times (HRT) than those using a single component of volatile fatty acids as a substrate. At an HRT of 4.43 days, the methanogenesis occurred normally up to a feed substrate concentration of 70,000 mg COD/liter. At a feed substrate concentration of 20,000 mg COD/liter, the methanogenesis occurred normally up to an HRT of 2.91 days and the minimum SRT for microbial populations was calculated to be 2.42 days. An increase in feed substrate concentration adversely affected the propionate degradation strikingly, while a decrease in HRT significantly adversely affected the acetate and propionate degradation. The methane production was 0.30 liter/g COD utilized, and it was independent of the feed substrate concentration and HRT. Bacilli were predominant in all reactors, but sarcinae appeared in the reactors with high feed substrate concentrations and short HRTs. Phenomena in digester failure due to methanogen washout were also observed. (Author's abstract)
W86-05345

REMOVAL OF PARAQUAT, DIQUAT, AND AMITROLE FROM AQUEOUS SOLUTION BY CHEMICALLY MODIFIED PEAT,
Colorado School of Mines, Golden. Dept. of Chemistry and Geochemistry.
For primary bibliographic entry see Field 5G.
W86-05383

BACTERIAL PROFILE OF PETROCHEMICAL INDUSTRY EFFLUENTS,
Baroda Univ. (India). Dept. of Biochemistry.
H. D. Goud, L. J. Parekh, and C. V. Ramakrishnan.
Environmental Pollution (Series A), Vol. 39, No. 1, p 27-37, 1985. 1 fig, 4 tab, 26 ref.

Descriptors: *Biodegradation, *Path of pollutants, *Fate of pollutants, *Industrial wastewater, *Hydrocarbons, *Bacteria, *Heavy metals, Bacillus, Pseudomonas, Aeromonas, Azotobcter, Cobalt, Copper, Lead, Mercury, Molybdenum, Zinc, Effluents, India.

The microbial profile of petrochemical industry effluents was investigated at different points in an activated sludge wastewater treatment plant in

Baroda, India. Chemical oxygen demand was higher than biological oxygen demand (BOD) in all samples. Among the 92 isolates, four bacterial cultures, Pseudomonas spp. P-51, Bacillus spp. P-79, Aeromonas spp. P-71 and Azotobacter spp. P-23, grew well on petrochemicals such as benzene, butanol, ethylene glycol, n-heptane, methanol, acetonitrile, phenol and xylene, and showed resistance to heavy metals such as cobalt, copper, lead, mercury, molybdenum and zinc. Preliminary studies using a mixture of the four bacteria showed a reduction in BOD in a sample petrochemical waste from 350 microgram/ml to 150 microgram/ml in 48 hr at 30 C. It is suggested that these bacteria may play an important role in the purification of petrochemical industry effluents. (Peters-PTT)
W86-05393

WASTE-WATER INJECTION: GEOCHEMICAL AND BIOGEOCHEMICAL CLOGGING PROCESSES,
San Jose State Univ., CA.
For primary bibliographic entry see Field 5E.
W86-05402

ELECTROCHEMICAL TREATMENT OF INDUSTRIAL WASTEWATER,
Vsesoyuznyi Nauchno-Issledovatel'skii Inst. Vodosnabzheniya, Kanalizatsii, Gidrotekhnicheskikh Sooruzhenii i Inzhenernoi Gidrogeologii, Moscow (USSR).
V. E. Cenkin, and A. N. Belevtsev.
Effluent and Water Treatment Journal, Vol. 25, No. 7, p 243-44, 246-247, July 1985. 4 fig.

Descriptors: *Electrodialysis, *Electrolysis, *Wastewater treatment, Industrial wastewater, Electrodes, Chromium, Cyanide, Electrochemistry, Advanced wastewater treatment, Wastewater oxidation, Coagulation, USSR, Organic compounds, Pulp and paper industry, Chemical wastes, Mine wastes, Dyes.2274.

Electrochemical wastewater treatment processes used in the USSR are discussed. Direct anodic oxidation entails the destruction of dissolved (usually organic) impurities in electrolysis units at high current densities. The process can be combined with cathodic reduction to treat wastewater containing cyanides, amines, aldehydes, azo dyes, mercaptans, and other by-products of the refining, pulp and paper, and chemical industries. Electrodialysis, used to treat mine waste effluents and to regenerate products from spent process solutions, involves separating inorganic salt ions from wastewater in multi-cell unit employing ion-exchange membranes. Electrocoagulation (Using Soluble Fe and Al anodes to form insoluble precipitates with contaminants) and electroflotation (with insoluble electrodes) are efficient agains dispersed impurities that form stable collodial systems in liquid: e.g., chromium compounds; sulfide, phosphate or fluoride ions. The efficiency and energy requirements of the processes are analyzed. (Robinson-PTT)
W86-05403

5E. Ultimate Disposal Of Wastes

EVALUATING THE IN-VESSEL COMPOSTING OPTION, PART I,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5D.
W86-04716

DENVER'S DUAL UTILIZATION SLUDGE PROGRAM,
Black and Veatch, Aurora, CO.
P. J. Psaris, and R. Tardy.
Biocycle BCYCDK, Vol. 27, No. 4, p 28-30, April 1986. 7 tab.

Descriptors: *Denver, *Sludge disposal, *Composting, *Land application, *Liquid sludge, Metrogro, Municipal wastewater, Colorado.

The Denver (Colorado) Sewage Disposal District No. 1's 'Dual Utilization' (DU) concept of sludge disposal is described. The District's Central wastewater treatment plant currently produces approximately 60-70 tons of anaerobically digested sludge per day, with a sludge load anticipated in the year 2004 by 100 dry tons/day. The DU concept, which consists of a combined approach of composting and land application, was chosen in 1981 as the best among the alternatives in the sludge management plan. Two products will be produced and marketed in 1986: compost and liquid, which are marketed under the trademark 'Metrogro.' The liquid constitutes 40% of the output applied to agricultural land. The District believes that the success of Metrogro Liquid is an example of what can be accomplished through public relations and promotion. The liquid portion of the program has gone from intense public resistance to an overwhelming success. (Rochester-PTT)
W86-04717

SLUDGE MANAGEMENT ALTERNATIVES FOR SAN DIEGO,
Nolte (George S.) and Associates, Sacramento, CA.
R. W. Crites, and D. Richard.
Biocycle BCYCDK, Vol. 27, No. 4, p 50-55, April 1986. 2 fig, 5 tab, 6 ref.

Descriptors: *Sludge disposal, *San Diego, *Composting, *Land application, *Management planning, Sod farming, Site selection, Landfilling, California.

The difficulties presented to the City of San Diego, California, by the need to move its sludge drying operation are described and management alternatives are discussed. A master plan is being prepared that examines alternatives to landfilling of dewatered sludge, including dedicated land disposal, agriculture use, land reclamation, composting, and ocean disposal. Considerable interest has been expressed in the beneficial use of sludge for agriculture, land reclamation, and distribution of compost. The present recommendation is for a sludge reuse program with multiple options that include distribution of compost as well as agricultural land application, land reclamation, and reuse in sod farming. Existing sludge management in San Diego, site selection, sludge characteristics, land application, and composting are discussed. (Rochester-PTT)
W86-04718

SULFUR OXIDES CONTROL TECHNOLOGY SERIES: FLUE GAS DESULFURIZATION; LIME/LIMESTONE PROCESSES,
Radian Corp., Austin, TX.
For primary bibliographic entry see Field 5D.
W86-04819

USE AND DISPOSAL OF MUNICIPAL WASTEWATER SLUDGE,
Eastern Research Group, Inc., Arlington, MA.
For primary bibliographic entry see Field 5D.
W86-04826

SEPTAGE TREATMENT AND DISPOSAL: HANDBOOK,
Weston (Roy F.), Inc., West Chester, PA.
For primary bibliographic entry see Field 5D.
W86-04828

ESTIMATING SLUDGE MANAGEMENT COSTS.
Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.
For primary bibliographic entry see Field 5D.
W86-04829

MUNICIPAL WASTEWATER SLUDGE COMBUSTION TECHNOLOGY.
Environmental Protection Agency, Cincinnati, OH. Center for Environmental Research Information.
For primary bibliographic entry see Field 5D.
W86-04835

PROCESS DESIGN MANUAL FOR LAND TREATMENT OF MUNICIPAL WASTEWATER: SUPPLEMENT ON RAPID INFILTRATION AND OVERLAND FLOW.
Environmental Protection Agency, Cincinnati, OH. Office of Water Program Operations.
For primary bibliographic entry see Field 5D.
W86-04840

RAPID INFILTRATION,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 5D.
W86-04841

OVERLAND FLOW,
ERM-Southeast, Inc., Brentwood, TN.
For primary bibliographic entry see Field 5D.
W86-04842

ENVIRONMENTAL ASPECTS OF THE COMBUSTION OF SEWAGE SLUDGE IN A UTILITY BOILER,
Stone and Webster Engineering Corp., New York.
D. Samela, G. M. Tsoumpas, G. K. Welshans, and M. L. Zwillenberg.
Environmental Progress, Vol. 5, No. 2, p 110-115, May 1986. 7 tab, 11 ref.

Descriptors: *Sludge disposal, *Combustion, *Air emissions, Pollutants, Leachates, Arsenic, Barium, Dewatering, Cadmium, Chromium, Lead, Mercury, Selenium, Silver, Zinc, Secondary wastewater treatment, Primary wastewater treatment.

The combustion of three dewatered municipal sewage sludges which were representative of sludges that could be considered for co-firing in a utility boiler was studied. Milorganite sludge (M sludge, Milwaukee, WI) is typically a residential-type sludge which has received secondary treatment and chemical treatment using ferric chloride ($FeCl_3$). M sludge is packaged and sold commercially as an organic fertilizer. The Atlantic City (NJ) sludge (A sludge) is also a residential type sludge; however, it is a primary treatment sludge that has not been biologically treated. The World Resources (Phoenix, AZ) Sludge (P sludge) is an industrial-type sludge which has received secondary treatment. The forms in which metals are found in sludge will influence their behavior on firing. High efficiency electrostatic precipitators or baghouses would be required to control total suspended particulate emissions. The emissions for CO, NO_2, and trace metals increased with sludge firing. The SO_2 emissions decreased for sludge/oil firing, but increased for sludge/coal firing. However, the SO_2 PSD (Prevention of Significant Deterioration) incremental consumption was well below the allowable limit for sludge coal firing. Air quality impacts were all well below the National Ambient Air Quality Standards. The quantity of solid wastes requiring handling and disposal increased significantly. The tested sludges did not demonstrate hazardous waste characteristics. However, there is a potential for a wide variability in the sludge composition due to differences in the quantity and character of the industrial wastes in the community, and the unit operations employed at the sewage treatment plant. (Peters-PTT)
W86-04948

FILTRATE AND CAKE QUALITY IN SLUDGE DEWATERING,
Nigeria Univ., Nsukka. Dept. of Civil Engineering.
J. O. Ademiluyi.
Effluent and Water Treatment Journal, Vol. 26, No. 3/4, p 114-117, March/April 1986. 4 fig, 25 ref.

Descriptors: *Sludge, *Dewatering, *Filtrate, Cake quality, Oil waste sludge, Beef sludge, Domestic sludge, Oxidation pond, Food-processing wastes, Industrial wastewater, Domestic wastes.

Sludge-dewatering factors such as pressure and sludge conditioning, were studied for their effects on sludge filtrability,as well as filtrate and cake qualities at constant vacuum pressure, especially

when the filtrate or cake is the primary product of filtration. Pressure and chemical conditioning affect the resulting cake and filtrate concentrations during sludge filtration. Cake concentration increases with increasing pressure. In the three sludges tested, oil waste, beef (from a slaughtering house), and domestic, different values were obtained for pressure versus filtrate concentration. Filtrate concentration can increase with the pressure, as shown by the oxidation pond and the beef sludges tested. A decrease in filtrate concentration with increasing pressure is obtained with the oil waste sludge tested. If the ultimate objective of a dewatering process is to obtain a high quality cake, high filtration pressure must be used, even through filtrability is low at such pressures. (Peters-PTT)
W86-04954

SANITARY LANDFILL LEACHATE RECYCLE,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
G. F. Lee, R. A. Jones, and C. Ray.
Biocycle BCYCDK, Vol. 27, No. 1, p 36-38, January 1986. 1 fig, 1 tab, 7 ref.

Descriptors: *Sanitary landfills, *Groundwater pollution, *Recycling, *Surface water, *Leachates, Monitoring, Remedies, Wastewater treatment, Landfills.

A general overview of the problems of landfill leachate recycle is presented. Leachate recycle can increase the rate of landfill stabilization and be used for leachate treatment and disposal, but may lead to increased groundwater contamination. Concentration ranges for components of landfill leachate and a suggested design for landfill leachate recycle system with gas reclamation are included. In general sanitary landfill leachate recycle will not likely provide a leachate that is sufficiently well-treated so that it may enter groundwater without fear of contamination problems or may be discharged into surface waters without further treatment. Basically, therefore, leachate recycle will reduce, to some extent, some contaminants in the leachate, but will require additional treatment by more conventional means. Rigorous monitoring and remediation programs must be conducted indefinitely to ensure that surface and/or groundwater contamination does not occur. Leachate recycle is likely to be most readily practiced at new landfills that have been properly designed and operated with a double-lined leachate collection system to minimize the likelihood of groundwater contamination. (Rochester-PTT)
W86-04971

EVALUATING MATURITY AND METAL TRANSFER OF MSW COMPOST,
Faculte des Sciences Agronomiques de l'Etat, Gembloux (Belgium).
P. J. Anid.
Biocycle BCYCDK, Vol. 27, No. 1, p 46-47, January 1986. 9 ref.

Descriptors: *Composting, *Trace metals, *Horticulture, *Soil tests, *Land disposal, *Municipal wastes, Toxicity, Crop yield, Thermophilic bacteria, Monitoring, Decomposition, Lettuce, Spinach, Rye, Zinc, Nickel.

Procedures were developed to monitor the decomposition of municipal sewer waste compost and to assess stabilization of composting material. The effects of various compost loadings on the quantitative and qualitative yields of spinach, rye grass, and lettuce were determined. In addition, the relation, if any, between soil metal content, conventionally extracted to actual crop uptake, and compost levels to avoid phytotoxicity were defined. Thermophilic bacteria may be at the origin of compost toxicity experienced during early stages of decomposition. The metal concentrations encountered in soil-compost mixtures and plant tissues were not sufficiently high to inhibit growth. Rye grass tolerates high compost applications, whereas a moderate application (20%) appears appropriate for sensitive crops such as lettuce and spinach, because their uptake capacity for trace elements, especially Zn and Ni, is high. Trace element contents in soil indicate the concentration potentially available, but cannot be used for predicting quantitative absorption by crops. (Rochester-PTT)
W86-04972

FEEDLOT MANURE USE ON DESERT CROPLAND,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
S. Hathorn, III, and W. H. Fuller.
Biocycle BCYCDK, Vol 27, No. 1, p 48-51, January 1986. 3 tab, 15 ref.

Descriptors: *Feedlot wastes, *Deserts, *Soil organic matter, *Heavy metals, *Cropland, Sorghum, Barley, Salts, Manure, Crop yields, Loading rate, Waste management, Waste load, Waste disposal, Arizona, Pima loam soils, Phosphorus, Ammonia, Nitrogen, Arid lands. (Rochester-PTT).

The effects of feedlot steer manure loading rate and cropping pattern upon the soil fertility status of arid land were determined, using the following evaluation criteria: optimal fertility on arid land; maximum manure utilization as a waste management alternative; and avoidance of excessive heavy metal accumulation in crops. Manure applications up to an approximate optimal rate of 178 metric ton/hectare will increase soil fertility/small grain yield benefit if production practices are adjusted to properly manage manure-borne salts (and/or ammonia). Even after following for 2 yr after manure application, residual soil fertility benefit and salinity hazard will be comparable to those expected from a planting immediately after manuring. A single 178 metric ton/hectare manure application will sustain overall soil fertility for economic yields of three consecutive small grain crops, after which soil N may be yield-limiting. Even a single manure application of 45 metric ton/hectare will increase and sustain desert soil organic matter and plant-available P to levels equal to or greater than native levels for at least 2 yr of small grain double-cropping. Manuring rates as great as 448 metric tons/hectare on Pima loam soils (Arizona, USA) did not result in statistically significant concentration of heavy metals in small grain commodities. (Rochester-PTT)
W86-04973

OMAHA MOVES FROM 'DISPOSE ALL' TO MANAGEMENT,
Omaha Public Works Dept., NE. Quality Control Div.
K. Stevens.
Biocycle BCYCDK, Vol. 27, No. 2, p 26-27, February 1986. 2 fig.

Descriptors: *Composting, *Organic wastes, *Recycling, *Sludge, *Management planning, *Omaha, Nebraska, Cost analysis, Wastewater treatment, Landfills, Nonstructural alternatives, Monitoring, Industrial wastes, Grass, Brush, Race track bedding, Marketing, Farm management, Horticulture, Soil reclamation, Turf maintenance.

The philosophy of management, 'organic processing centers', compost trials, and other activities employed by Omaha, Nebraska, wastewater treatment plants are described. The present program generates and applies to land 40,0900 cubic yd of dewatered, digested sewage sludge on 9 farms in 2 counties at a cost of $6.00 per yard, including costs of hauling, spreading, monitoring, and management. Major components of the program currently underway or soon to start include: source separation of grass clippings, chipped brush, race track bedding, and selected industrial wastes for composting at a regional facility, separate collections of organics in selected areas, a market survey intended to aid in targeting the most practical fraction of the market for the compost, policy development for landfilling and recycling, and creation of an incentive system to encourage haulers to compost rather than landfill organics. Compost trials are being conducted to determine effective use of compost in agriculture, turf maintenance, horticulture, and soil reclamation. Other efforts include development of a landfill ordinance to control illegal dumping and other planning activities concerned with recycling organics. (Rochester-PTT)
W86-04974

UPGRADING WITH SPRAY IRRIGATION,
Tatman and Lee Associates, Wilmington, DE.
M. F. Prouty.
Biocycle BCYCDK, Vol. 27, No. 2, p 54, February 1986. 1 fig.

Descriptors: *Water reuse, *Spray irrigation, *Wastewater lagoons, Fire fighting, Hay, Oxford, Pennsylvania, Wastewater facilities, Wastewater renovation, Disinfection, Orchard grass, Pine trees, Federal funding, Cost sharing, Costs.

Improvements in the new spray irrigation system at Oxford, Pennsylvania, include deeper storage lagoons, complete water recycling, fire fighting capacity, and a hay crop. The basic components of the plant are collection sewers, a lift station, three treatment and storage lagoons, an operations building with laboratory and effluent pumps. The wastewater collected in the lagoons is treated and disinfected. It is then sprayed onto fields planted with orchard grass and pine trees. The treatment plant is capable of treating and irrigating 600,000 gallons of sewage per day. The facility received 85% federal funding of a total cost of $4,278,300. (Rochester-PTT)
W86-04975

LEACHING TESTS OF HEAVY METALS STABILIZED WITH PORTLAND CEMENT,
New Hampshire Univ., Durham.
W. Shively, P. Bishop, D. Gress, and T. Brown.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 3, p 234-241, March 1986. 5 fig, 2 tab, 38 ref.

Descriptors: *Waste disposal, *Leaching, *Heavy metals, *Portland cements, *Stability analysis, *Equilibrium, Sludge, Water pollution sources, Hydrogen ion concentration, Chemical analysis, Chemical reactions, Alkalinity, Arsenite, Calcium, Cadmium, Aluminum, Chromium, Iron, Lead, Acetic acid, Nitric acid, Silicon.

The leaching of heavy metals sludges was substantially reduced by solidification and stabilization with Portland cement. Heavy metal concentrations in the 15 tested extractions were 100 to 10,000 times less than concentrations predicted for equilibrium solubility of stable hydroxide solids. All samples passed the EPA EP-toxicity test and are not considered hazardous waste. Heavy metals in the sludges were diluted by the stabilization process, and this dilution by salts, hydroxides, and cement compounds helped the stabilization process. Release of heavy metals proceeded in three phases during the sequential extractions. During the first phase, calcium hydroxide neutralized all acid in the leachate and the final pH was greater than 10.0. Little degradation of the solid cement paste occurred. Precipitation and soprtion removed small amounts of heavy metals extracted. Peak releases for the more soluble metals occurred as the pH dropped to less than 6.0. The pH of subsequent extractions remained less than 6.0 and the less soluble metals began to be released in small but increasing amounts. The heavy metals released in each extraction were related to the amount in each sample, and releases occurred during the same extraction regardless of concentration in the sample. Substantial amounts of heavy metals remained in the silicon-rich solids after the alkalinity had been neutralized during the 15 extractions. Arsenite, calcium, and cadmium were primarily leached during the extractions. Most of the aluminum, chromium, iron, and lead were leached during the acetic and nitric acid digestions. Acid flux was strongest during these digestions, and leaching was probably related to cement paste decomposition. Silicon remained in the solids after the other elements had leached and was dissolved by the hydrofluoric acid digestion. The stabilized wastes exhibited large buffering capacities; the average was 18.3 microequivalents/g. Alkalinity was provided primarily by calcium hydroxide in the cement paste. The high alkalinity was integral to part of the stabilization process. (Lantz-PTT)
W86-05054

SLUDGE MANAGEMENT GOES THE DISTANCE,
Brown and Caldwell, Denver, CO.
S. Berg.
Water/Engineering & Management, Vol. 133, No. 4, p 26-27, April 1986.

Descriptors: *Sludge disposal, *Colorado Springs, *Wastewater management, *Pipelines, National Pollutant Discharge Elimination Systems, Wastewater facilities, Regulations, Anaerobic digestion, Computers, Stabilization ponds, Land disposal, Monitoring.

A new concept 18 mile sludge pipeline saves half a million dollars in trucking fees each year and provides Colorado Springs with long term wastewater relief. In 1978, after the EPA filed a civil suit against Colorado Springs for noncompliance with the National Pollutant Discharge Elimination System (NPDES), the city endorsed a comprehensive program to bring the treatment system into compliance and to develop a 20 year master facilities plan for wastewater management. From the 1973 start up, sludge had been a problem. The 20 year master plan includes a solids management plan, a facility planning study, an interim sludge handling and disposal study, and later, design and construction management services. The new handling system is compatible with the treatment system, but not with the treatment plant's confined site. It was recommended that the solids handling and disposal system be located on a separate site, the city owned Hanna Ranch, 18 miles to the south. A 17.7 mile dual pipeline transfers a thickened blend of primary and secondary raw sludge from the plant to four new 1.8 mg anaerobic digesters at the ranch and carries supernatant back to the plant for treatment. The ranch site also contains six 21 mg facultative sludge basins to further stabilize and store the digested sludge, a 200 acre dedicated land disposal site for subsurface injection of sludge, and an operations building. An activated sludge wastewater treatment plant processes flows up to 30 mgd in a trouble free operation, producing 22 dry tons per day of sludge, which is processed at a cost of about $120 per dry ton. At Hanna Ranch, an operator sits at a computerized graphic control panel and monitors process functions and plant support equipment 12 hours a day. During unmanned hours, computerized alarms alert an operator in the activated sludge plant control room. The two facilities maintain their compatibility, communicating the 18 miles through a microwave link. (Peters-PTT)
W86-05121

AT THE ROOT OF THE MATTER,
For primary bibliographic entry see Field 5D.
W86-05122

SOIL AND SLASH PINE RESPONSE TO SLUDGE APPLICATIONS IN FLORIDA,
North Dakota State Univ., Fargo. Dept. of Soil Science.
M. C. Lutrick, H. Riekerk, and J. A. Cornell.
Soil Science Society of America Journal, Vol. 50, No. 2, p 447-451, March/ April 1986. 8 tab, 2 fig, 15 ref.

Descriptors: *Sludge disposal, *Pine trees, *Minerals, Sandy soil, Toxic metals, Heavy metals, Zinc, Mercury, Cadmium, Lead, Nitrogen, Potassium, Calcium, Magnesium, Nickel, Florida, Phosphorous, Leaching, Soil profiles, Nutrients, Sandy loam, Nitrates.

The response of slash pine (Pinus elliottii Engelm.) to sludge applications on a Troup fine sandy loam (Grossarenic Paleudults) and the subsequent movement of nutrients and other elements into the growing trees and through the soil profile were determined. The sewage sludge contained 26 g/kg (2.6%) solids. The sludge was applied only once to an area planted to pine seedlings, at rates of 0, 20, 40, 60, 80, and 100 Mg/ha dry matter. The large amount of N (730-3650 kg/ha) in the sludge treatment limited the amount of sludge that could be applied to slash pine grown on a Troup fine sandy loam (Grossarenic Paleudults), since NO3 could leach into the ground if sludge were applied in excessive amounts. Large amounts of P and Zn also were added to the soil from the sludge, but neither moved down the soil profile beyond the 90 cm sampling depth. After 4 yr of growth, the N and P concentration in pine needles had increased significantly from the sludge treatments, but after 8 yr, the N and P concentration in needles was not significantly different among treatments. However, the Ca concentration in pine needles increased due to treatment after 4 years. Addition of sludge increased individual tree growth by 0.8 cu dm/yr and increased annual yield by 1.0 cu m/ha per 10 Mg/ha sludge. (Peters-PTT)
W86-05127

FEASIBILITY OF CONSTRUCTING A WASTE-TO-ENERGY INCINERATOR TO GENERATE ELECTRICITY FOR A COLOCATED WASTEWATER TREATMENT PLANT,
Dayton Univ., OH. Dept. of Civil Engineering.
G.B. Shaw, J. W. Norton, and B. S. Middlebrooks.
Journal of the Water Pollution Control Federation, Vol. 58, No. 4, p 267-271, April 1986. 1 fig, 7 tab, 1 ref.

Descriptors: *Incineration, *Solid waste disposal, *Municipal wastes, *Cost analysis, *Electric power costs, *Wastewater treatment, Waste disposal, Landfills, Energy conversion, Energy, Feasibility studies, Electric power production.

The Montgomery County, Ohio Eastern Regional wastewater treatment plant is undergoing extensive improvements to increase its capacity from 37,850 cu m/d to 49,205 cu m/d. The county studied the feasibility of constructing a small scale waste-to-energy incinerator near the wastewater treatment to use municipal solid waste to run the plant. After analyzing controlled air and excess air incineration technologies, a 227-ton/d excess air refractory wall system was chosen for implementation at the Eastern Regional site. This system combines low capital costs and operating and maintenance costs, high availability and reliability, long life span, a first-year tipping fee (solid waste deposition fee) comparable to landfill costs, and the greatest opportunity for revenues from the sale of excess electricity. Ash from the resource recovery facility is not expected to be toxic and odors and noise should not present problems. Cost savings realized by the waste-to-energy facility could yield a number of benefits for county residents. (Geiger-PTT)
W86-05129

MONITORING AND EVALUATING COMPOSTING PROCESS PERFORMANCE,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
M. S. Finstein, F. C. Miller, and P. F. Strom.
Journal of Water Pollution Control Federation, Vol. 58, No. 4, p 272-278, April 1986. 2 fig, 47 ref.

Descriptors: *Sludge disposal, *Composting, *Waste disposal, *Monitoring, Process control, Performance evaluation, Drying, Decomposition, Microbial degradation.

The use of composting as a sludge treatment process has developed rapidly, but without the benefit of a specific, objective criterion of process performance. This has led to unnecessary expense and widespread problems, particularly with odor generation. This study explores possible means of assessing decomposition rate in field practice. Tests involving organic content include total organic carbon, volatile solids, carbon-to-nitrogen ratio, chemical oxygen demand, biochemical oxygen demand, materials balance, starch, cellulose, and other tests. These tests have proven inadequate, mainly because of poor specificity and sensitivity, while tests involving manifestations of decomposition are not applicable to field-scale systems. Two approaches unique to composting which seem very promising are ventilation demand and course of drying. The demand for ventilation stems from heat generation, which is directly related to decomposition. Although limited to systems using temperature feedback control, it is the preferred method for routine monitoring because of its ease and instantaneous results. The course of drying depends on water vaporization, which results mainly from heat generation. It is useful in any system as long as conduction heat loss is not a major heat removal mechanism. (Geiger-PTT)
W86-05130

MUNICIPAL SLUDGE COMPOSTING TECHNOLOGY EVALUATION,
Brown and Caldwell, Walnut Creek, CA.
A. H. Benedict, E. Epstein, and J. N. English.
Water Pollution Control Federation Journal, Vol. 58, No. 4, p 279-289, April, 1986. 5 fig, 9 tab, 15 ref. EPA contract 68-03-1818.

Descriptors: *Composting, *Comparison studies, *Municipal wastes, *Sludge disposal, Performance evaluation, Aeration, Drying, Cost analysis, Digested sludge, Solid waste disposal, Waste disposal.

Five municipal sludge composting facilities were evaluated for operation, performance, and cost features. Three were static pile facilities, one used conventional operations, and the other remaining facility used aerated windrow operations. In general it was concluded that unit operating areas of about 0.03 to 0.08 ha/wet mg/d are required based on the 45- to 450-wet mg/d facilities studied. Moisture control, combined with effective mixing, during day-to-day operation was the single most important factor for effective composting. Flexibility to respond to variable sludge loadings, weather conditions, and day-to-day problems was also an important operating requirement. Under optimum conditions, wood chip recoveries of 80 to 90%, based on unscreened compost volume, can be achieved during screening. The integration of treatment plant and composting operations is important for effective composting. Based on experience at the conventional windrow facility, preliminary mixing with front-end loaders before windrow formation was not completely effective; pugmill mixing is being considered as an alternative. At the aerated windrow facility, induced aeration improved drying by about 2 to 3% over conventional windrowing. Sustained finished compost production was equivalent to about 0.6% to 2.2 dry mg/dry mg sludge processed. Finished compost production was affected by the type of sludge processed, but not the composting technology. The chief environmental problem at the facilities studied was odor generation and its resulting offsite impact. Operating and maintenance costs were $28-$40/wet mg for static pile facilities. (Geiger-PTT)
W86-05131

PRACTICAL APPLICATIONS OF GEOLOGICAL METHODS AT THE WEST VALLEY LOW-LEVEL RADIOACTIVE WASTE BURIAL GROUND, WESTERN NEW YORK,
New York State Geological Survey/State Museum, Albany.
R. H. Fakundiny.
Northeastern Environmental Science, Vol. 4, No. 3-4, p 116-148, 1985. 15 fig, 1 tab, 57 ref.

Descriptors: *Radioactive waste disposal, *Landfills, *Geology, *Leaching, Infiltration, Waste disposal, Land disposal, Groundwater movement, Clay, Flooding, Path of pollutants, Monitoring, Trenches.

Geologic studies of a radioactive-waste landfill in northern Cattaraugus County, New York evaluated the feasibility of low-level radioactive waste disposal by shallow burial in glacial deposits of the humid northeastern United States. Major topics addressed on the studies included regional geology of glacial deposits, site stratigraphy and petrography, engineering and fluid properties of burial-host material measured in situ and in the laboratory, geomorphic processes, groundwater movement and chemistry, burial-trench dynamics in relation to atmospheric pressure and precipitation, surface-water flow, and biological paths for radionuclide movement. The 8-year series of studies has shown that, although remedial maintenance at the site is safe and necessary, the technique is safe and feasible if the waste is catalogued properly upon arrival and is compacted and buried in a manner that prevents later changes in waste volume and if

water is prevented from infiltrating the burial trench. (Geiger-PTT)
W86-05138

SIMULATION OF FLUID FLOW AND ENERGY TRANSPORT PROCESSES ASSOCIATED WITH HIGH-LEVEL RADIOACTIVE WASTE DISPOSAL IN UNSATURATED ALLUVIUM,
Geological Survey, Reston, VA.
D. W. Pollock.
Water Resources Research WRERAO, Vol. 22, No. 5, p 765-775, May 1986. 12 fig, 4 tab, 21 ref.

Descriptors: *Simulation analysis, *Fluid flow, *Energy transfer, *Radioactive waste disposal, *Alluvium, Unsaturated flow, Great Basin, Nevada, Path of pollutants, Groundwater pollution, Mathematical models, Permeability, Prediction.

A mathematical model accounting for the coupled transport of energy, water (vapor and liquid), and dry air was used to analyze one-dimensional, vertical transport above and below an areally extensive repository of the Great Basin. Numerical simulations were conducted for a hypothetical repository containing spent nuclear fuel and located 100 m below the land surface. Initial steady state downward water fluxes of zero (hydrostatic) and 0.0003 m/yr, were considered in an attempt to bracket the likely range in natural water flux. Predicted temperatures within the repository peaked after approximately 50 years and declined slowly thereafter in response to the decreasing intensity of the radioactive heat source. The alluvium near the repository experienced a cycle of drying and rewetting in both cases. The extent of the dry zone was strongly controlled by the mobility of liquid water near the repository under natural conditions. In the case of initial hydrostatic conditions, the dry zone extended approximately 10 m above and 15 m below the repository. For the case of a natural flux of 0.0003 m/yr, the relative permeability of water near the repository was initially more than 30 times the value under hydrostatic conditions, consequently the dry zone extended only about 2 m above and 5 m below the repository. In both cases a significant perturbation in liquid saturation levels persisted for several hundred years. This analysis illustrates the extreme sensitivity of model predictions to initial conditions and parameters, such as relative permeability and moisture characteristic curves, that are often poorly known. (Lantz-PTT)
W86-05223

LAND APPLICATION OF DOMESTIC WASTEWATER, WOOD PRODUCTION, AND SLUDGE COMPOSTING: AN INTEGRATED DESIGN,
Nebraska Univ.-Lincoln. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3C.
W86-05293

AVAILABILITY OF APPLIED HEAVY METALS AS A FUNCTION OF TYPE OF SOIL MATERIAL AND METAL SOURCE,
Maryland Univ., College Park. Dept. of Agronomy.
R. F. Korcak, and D. S. Fanning.
Soil Science, Vol. 140, No. 1, p 23-34, July 1985. 2 fig, 7 tab, 23 ref.

Descriptors: *Sludge disposal, *Soil amendments, *Heavy metals, *Soil types, *Corn, Cadmium, Copper, Nickel, Zinc, Adsorption, Digested sludge, Land disposal, Plant tissues.

Cd, Cu, Ni, and Zn were applied as sulfate salts and digested sewage sludge to surface and subsurface horizon materials of six Maryland soils in the greenhouse. Metal levels were monitored in soil and corn grown for 30 days, 13 months after treatment application. Compared with limed and fertilized controls, yields of plant material were generally enhanced by sludge and suppressed by metal salts. Tissue levels of both Cd and Zn were considerably elevated, compared with the limed control, by both metal salts and sludge. Diethylenetriaminepentaacetic acid-extractable levels of metals were elevated by both metal salts and sludge, compared with limed controls. High-CEC soil materials and materials higher in Fe and Mn oxides generally gave lower diethylenetriaminepentaacetic acid-extractable metal values with both metal salts and sludge and the lowest levels of tissue metals with metal salt treatment. An interaction between type of soil material and source of metal on plant tissue metal levels was observed. Inert soil materials tended to produce tissue with the highest metal levels when metal-salt-treated, but with the lowest metal levels when sludged. Conversely, reactive soil materials tended to produce tissue with relatively lower levels of metals than other materials when metal-salt-treated, but with relatively high levels when sludged. (Geiger-PTT)
W86-05299

EVIDENCE FOR MOVEMENT OF HEAVY METALS IN A SOIL IRRIGATED WITH UNTREATED WASTEWATER,
Chile Univ., Santiago. Dept. of Analytical Chemistry.
T. Schirado, I. Vergara, E. B. Schalscha, and P. F. Pratt.
Journal of Environmental Quality, Vol. 15, No. 1, p 9-12, January-March 1986. 7 tab, 20 ref.

Descriptors: *Wastewater disposal, *Leaching, *Heavy metals, *Wastewater irrigation, *Fate of pollutants, *Arid lands, *Soil profiles, Cadmium, Cobalt, Chromium, Copper, Manganese, Zinc, Path of pollutants.

This paper presents data for heavy metals in a soil located in an arid area that had been irrigated exclusively with untreated municipal sewage for over 50 yr along with indirect evidence of the downward movement of these metals. A Vertisol irrigated for over five decades with an untreated municipal wastewater had elevated levels of diethylenetriaminepentaacetic acid extractable Cd, Co, Cu, Mn, Ni, and Zn in the cultivated layer of the soil as compared to lower layers. Total Co, Ni, and Zn were uniformly distributed in the 150-cm depth of the soil profile while Cu increased with depth. Total Cd, Cr and Mn had higher concentrations in the cultivated layer than in some deeper layers. Assuming that the added metals had accumulated in the cultivated layer of the soil and assuming uniform distributions of metals in the soil profile at the start of irrigation with wastewater, the amounts of metal added would have produced increased concentrations in the cultivated layer. Except for Mn, these expected differences were not found. These results suggest that the metals Cd, Co, Cr, Cu, Ni, and Zn may have migrated downward from the cultivated layer and are now distributed throughout the soil profile or leached below the depth of sampling. (Geiger-PTT)
W86-05322

SEWAGE SLUDGE AS A COAL MINE SPOIL AMENDMENT FOR REVEGETATION IN COLORADO,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
K. F. Topper, and B. R. Sabey.
Descriptors: *Soil amendments, *Land disposal, *Municipal wastes, *Sludge Revegetation, Coal mines, Land reclamation.

Descriptors: Revegetation, Coal mines, Land reclamation.

Use of digested municipal sewage sludge as an amendment for revegetation of a Colorado coal mine spoil was evaluated as a function of application rate. Plant growth responses to sewage sludge additions were compared to inorganic nitrogen (N) and phosphorus (P) fertilizer treatments on a grass pasture mixture. Sewage sludge additions resulted in significant increases in aboveground biomass and percent canopy cover over the control for two seasons of growth following sludge application. Sewage sludge rates 83 mg/ha yielded greater plant growth than any of the inorganic N and P fertilizer treatments for both growing seasons. However, the lowest level of sewage sludge (14 mg/ha) resulted in equivalent total N and total P concentrations of the seeded grasses when compared to the highest inorganic fertilizer treatments. The superior growth associated with sewage sludge additions at less than 83 mg/ha was due to measured increases in nutrient availability, improved physical condition of the spoil and a possible stimulation of microbial activity. The highest level of sewage sludge (83 mg/ha) was detrimental to seeded grass growth when compared to the lower sludge rates in 1984. This may have been due to increased soluble salt concentrations, an increase in competition by invading annual forbs, and/or elemental toxicities. Further research is necessary to determine the exact causes. (Author's abstract)
W86-05323

SAFE USE OF THE ASSIMILATIVE CAPACITY OF THE MARINE ENVIRONMENT FOR WASTE DISPOSAL - IS IT FEASIBLE,
Ministry of Agriculture, Fisheries and Food, Burnham on Crouch (England). Fisheries Lab.
For primary bibliographic entry see Field 5G.
W86-05376

EFFECTS OF FERTILIZER, PIG MANURE, AND SEWAGE SLUDGE ON TIMOTHY AND SOILS,
Nova Scotia Agricultural Coll., Truro.
P. R. Warman.
Journal of Environmental Quality JEVQAA, Vol. 15, No. 2, p 95-100, April-June 1986. 9 tab, 32 ref.

Descriptors: *Fertilizers, *Manure, *Wastewater disposal, *Timothy, Soil organic matter, Soil fertility, Wastewater treatment, Sludge, Plant tissue, Tissue analysis, Grasses, Agricultural chemicals, Quebec, Soil amendments.

Research determined the effect of fertilizer, sewage sludge and pig (Sus scrofa domesticus) manure on timothy (Phleum pratense L.) yield, tissue composition, and soil fertility from 1979 to 1982. Field plots in Quebec on sandy loam and clay loam soils compared no fertilizer with annual applications (1979-1981) of two rates of fertilizer (F1, F2 = 110-50-85, 220-50-85 kg/ha N-P2O5-K2O), pig manure (PM1, PM2 = 75 150 wet mg/ha) or aerobically digested sewage sludge (SS1, SS2 = 150 300 wet Mg/ha). The F2, PM2, and SS2 amendments produced similar yields and plant uptake of nutrients all 3 years. Although nutrient uptake by timothy was generally higher on the clay loam, due to higher soil fertility and less leaching losses, the percent recovery of the applied nutrients (excluding N and Mn) was similar at both sites. Based on the K:(Ca + Mg) content and regardless of the treatment applied, a potential grass tetany problem exists in the timothy grown in the clay loam. No metal contamination was found in the soil or timothy following the application of any amendment. Of 11 measured soil chemical properties, only four were influenced by the treatments on either soil. The PM2 treatment increased NO3(-)-N, Bray P sub 2 and extractable K. The SS2 treatment increased Bray P sub 2 and DTPA (diethylenetriaminepentaacetic acid) Cu. It is therefore recommended that the amendments be applied to the timothy at either of the two rates. (Lantz-PTT)
W86-05382

EVALUATION OF NITROGEN AVAILABILITY INDEXES FOR A SLUDGE COMPOST AMENDED SOIL,
Maryland Univ., College Park. Dept. of Agronomy.
B. E. O'Keefe, J. Axley, and J. J. Meisinger.
Journal of Environmental Quality JEVQAA, Vol. 15, No. 2, p 121-128, April-June 1986. 2 fig, 7 tab, 22 ref.

Descriptors: *Nitrogen, *Nutrient availability, *Sludge, *Compost, *Wastewater farming, Land disposal, Silt, Loam, Beltsville, Maryland, Corn plants, Chemical analysis, Biological analysis, Regression analysis, Statistical analysis.

Several N availability methods were evaluated on a sludge amended soil, since sludge applications are

usually based on N availability and a soil N evaluation to optimize loading rates. Yearly amendments of composted, lime-stabilized, raw sludge were applied, at 0, 56, 112, and 224 mg/ha, to an Elkton silt loam soil (Typic Orchraquults), in Beltsville, MD, as follows: whole plots (1975-1977), half plots (1978), and no plots (1979-1981). In 1978 and 1981, surface and subsurface soil samples were collected, and maize (Zea mays L.) total N uptake was determined. The biological method (total nitrogen mineralization (NT)) of assessing soil N availability revealed an initial rapid mineralization phase (NE) over the first 28 weeks and a constant phase thereafter. The chemical methods were total soil N (TN), acid KMnO4 oxidizable N (P), autoclave extractable N (A), and 2 M KCl extractable NH4(+)-N (K). Curvilinear regression analyses, relating maize N uptake to these N indexes, gave the following R2 values: NE, 0.93; NT, 0.94; TN, 0.93; P, 0.92; A, 0.95; and K, 0.92. All methods were equally sensitive on sludge treated soils, but the incubation procedure was best on untreated soil. Including second zone soil N, and expressing the results on a root-zone volume basis, improved N uptake predictions with unfertilized controls, but was unnecessary for sludge treated plots. These results indicate that chemical N availability indexes can be used to assess soil N availability on sludge treated land, provided they are calibrated to local soil-crop-climate conditions. (Lantz-PTT)
W86-05386

PREDICTION OF AVAILABLE ZINC IN SEWAGE SLUDGE-AMENDED SOILS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
B. D. Rappaport, D. C. Martens, T. W. Simpson, and R. B. Reneau, Jr.
Journal of Environmental Quality JEVQAA, Vol. 15, No. 2, p 133-136, April-June 1986. 3 tab, 31 ref.

Descriptors: *Zinc, *Nutrient availability, *Sludge, *Wastewater farming, Virginia, Corn plants, Diethylenetriaminepentaacetic acid, Regression analysis, Soil chemistry, Land disposal, Statistical analysis, Soil amendment.

A routine soil test would be helpful for the management of agricultural soils amended with sewage sludge high in Zn. Fourteen field sites were selected in the Coastal Plain, Piedmont, and Ridge and Valley regions of Virginia to evaluate the suitability of dilute HCl-H2SO4 and DTPA (diethylenetriaminepentaacetic acid) soil extractants for predicting Zn uptake by corn (Zea mays L.). Soil and corn tissue samples were collected from these sites where sewage sludge has been applied previously. Multiple regression analysis was used to assess the forms of soil Zn extracted by dilute HCl-H2SO4 and DTPA. The exchangeable and specifically sorbed, organically bound and noncrystalline hydroxide and oxide bound Zn fractions were tested to develop the equations. Dilute HCl-H2SO4 extracts were related to the three Zn fractions ($R2 = 0.98$), whereas organically bound Zn was the only Zn fraction related to DTPA-extractable Zn ($r = 0.96$). Earleaf Zn concentration correlated more closely with DTPA-extractable Zn ($r = 0.64$) than with dilute HCl-H2SO4-extractable Zn ($r = 0.35$). The earleaf Zn concentration was studied as a function of either DTPA- or dilute HCl-H2SO4-extractable Zn, exchangeable and specifically sorbed Zn, organically bound Zn, and noncrystalline hydroxide and oxide bound Zn. Inclusion of the above fractions in a multiple regression analysis did not improve the relationship between earleaf Zn concentration and dilute HCl-H2SO4-extractable Zn. A coefficient of multiple determination ($R = 0.77$) was obtained between earleaf Zn concentration and a two variable regression equation comprised of DTPA-extractable Zn and organically bound Zn. The negative regression coefficient for organically bound Zn indicated that a portion of this fraction, which was extracted by the DTPA, did not supply Zn to corn plants. (Lantz-PTT)
W86-05387

POTASSIUM LOSSES IN RUNOFF AND DRAINAGE WATERS FROM CROPPED, LARGE-SCALE LYSIMETERS,
Illinois Univ. at Urbana-Champaign. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W86-05388

MINERALIZATION OF NITROGEN IN SOILS AMENDED WITH ORGANIC WASTES,
Iowa State Univ., Ames. Dept. of Agronomy.
Y. M. Chae, and M. A. Tabatabai.
Journal of Environmental Quality JEVQAA, Vol. 15, No. 2, p 193-198, April-June 1986. 3 fig, 7 tab, 30 ref.

Descriptors: *Nitrogen, *Mineralization, *Sludge disposal, *Soil amendments, *Organic wastes, Manure, Sludge, Leaching, Leachates, Wastewater farming, Soil types, Corn, Alfalfa, Soybeans.

This study was conducted to compare the mineralization of N in soils amended with various sewage sludges, animal manures, and plant materials. In this work, field-moist soils amended with organic waste materials at a rate of 50 mg/ha were mixed with glass beads, packed in leaching columns, leached with 5 mM CaCl2 to remove the mineral N, and incubated at 30 C. The leaching procedure was repeated every 2 weeks for 26 weeks, and the leachates were analyzed for NO3(-)-N. With the exception of alfalfa (Medicago sativa L.), mineralization of N exhibited a slow initial rate, which was indicative of a lag period, followed by a rapid increase in rate, and subsequent slow rate of N release. The total N mineralized from the organic waste materials varied considerably, depending on the type of soil and organic waste material. The total N mineralized in five unamended soils ranged from 91 mg N/kg with Lester soil, to 337 mg N/kg with Webster soil. The amounts of N mineralized in soils amended with sewage sludges and animal manures ranged from 156 to 668 mg N/kg soil and from 176 to 617 mg N/kg soil, respectively. The total N mineralized in soils amended with plant materials ranged from 0 in 3 soils amended with sawdust to 983 mg N/kg for Webster soil amended with alfalfa. Expressed as a percentage of total organic N added to soils, the N mineralized ranged from 1 to 58% for sewage sludges and from 13 to 67% for animal manures. The percentage of organic N mineralized in plant materials ranged from 3% for soybeans to 97% for alfalfa. Addition of corn residue or sawdust resulted in decreases in N mineralization ranging from 3 to 687%. Soil types have marked effects on the mineralizable N pools and first order rate constants. (Lantz-PTT)
W86-05391

WASTE-WATER INJECTION: GEOCHEMICAL AND BIOGEOCHEMICAL CLOGGING PROCESSES,
San Jose State Univ., CA.
J. A. Oberdorfer, and F. L. Peterson.
Ground Water GRWAAP, Vol. 23, No. 6, p 753-761, November-December 1985. 6 fig, 18 ref.

Descriptors: *Injectin wells, *Well hydraulics, *Clogging, Municipal wastewater, Bacteria, Denitrification, Underground waste disposal, Nitrogen, Organic compounds, Hawaii.

Examination of near-well clogging processes at two experimental injection sites in Hawaii (Waimanalo and PaalaaKai wastewater treatment plants, Oahu) showed that filtration of suspended solids is not a long-term cause of clogging. Particulate filtration is probably a short-term cause of clogging at the start-up of injection, the injection organics are biodegraded once the microbial biomass becomes established. The injection head gradient determined from monitoring wells shows that most of the initial head loss is immediately adjacent to the well, but that after several weeks it shifts to a region > 0.5 to 1 m from the well. Denitrifying bacteria become sufficiently numerous to produce significant amounts of nitrogen gas, which in turn produces a gas-bound zone about 0.5 to 1 m from the well. With continued injection, the nitrogen gas-bound zone slowly extends farther out into the injection stratum. Dissolutin of the carbonate aquifer (carbonate sand, coral and recemented reef rubble) also occurs, but its effects are partially masked by gas binding. (Author's abstract)
W86-05402

ALKYLATE SLUDGE REUSE POTENTIAL,
Fluor Technology, Inc., Irvine, CA.
J. E. Cotter.
Environmental Progress, Vol. 4, No. 3, p 165-167, 4 fig, 2 tab, 3 ref.

Descriptors: *Sludge disposal, *Chemical sludge, *Sludge utilization.

In alkylation units of oil refineries, the primary waste stream is produced as a bottom draw from the acid regenerator. The waste stream is a sludge made of acid soluble oils (ASO), and water, tars, and traces of other components. A detailed discussion of the pros and cons of alternative reuse possibilities is given. The quantities of ASO and polymer that are generated, per unit of production, vary considerably from one alkylate sludge are given. One is to use ASO and polymer wastes as fuel. Another approach is to take advantage of hydrocarbon content by reintroducing the waste in the refinery product stream. The various options include reuse as a refinery fuel, recycle to refinery fuels, incineration without heat recovery, neutralization and disposal, and disposal without treatment. The technical, environmental and cost considerations of each options are discussed. It is concluded that the cost of pretreatment will pay out in a few years, by avoiding the damage to the alkylation equipment that would otherwise occur. (Master-PTT)
W86-05406

5F. Water Treatment and Quality Alteration

CONTROLLING TASTE AND ODOR WITH CHLORINE DIOXIDE,
Galveston County Water Authority, TX. Surface Water Treatment Plant.
G. L. Myers, and A. L. Thompson.
Southwest and Texas Water Works Journal, Vol. 67, No. 12, p 4-6, 10.

Descriptors: *Taste, *Odor control, *Chlorine dioxide, *Algicide, Galveston, Texas, Ozone, Potassium permanganate, Chlorine, Activated carbon, Powdered carbon, Granular carbon, Trihalomethane, Ammonia, Chlorite, Disinfectant, Oxidant, Chlorination, Water treatment facilities, Hydrogen ion concentration.

The Galveston (Texas) County Water Authority has tried several water treatment methods to provide satisfactory disinfection while avoiding the trihalomethane and ammonia problems associated with free chlorination and chloramination, respectively. Chlorine dioxide was selected as the most likely to meet these requirements, but initial attempts at its employment produced unsatisfactory results. Later, after studies of methods of chlorine dioxide generation and chlorine dioxide and chlorite residual measurements, new equipment was selected and another attempt to use this disinfectant was made. Chlorine dioxide has proven to be an effective, reliable method of preoxidation. It has been a highly effective algicide and taste and odor reducing agent. Its disinfection ability is not changed or diminished by changes in pH. These factors as well as the ability of the proper chlorine dioxide generator to produce high purity chlorine dioxide and chlorine dioxide having a longer-lasting residual than chlorine, suggest this substance as an excellent post-disinfectant as well as an excellent pre-oxidant. (Rochester-PTT)
W86-04733

WATER IS THE KEY TO MUNICIPAL GROWTH,
Scepter Mfg. Co. Ltd., Scarsborough (Ontario).
For primary bibliographic entry see Field 6D.
W86-04734

USING A FILTER TO REMOVE GIARDIA CYSTS,
Oregon State Parks and Recreation Branch, Salem.

J. E. Hollingsworth, R. E. Holt, and W. Hults.
Public Works, Vol. 117, No. 3, p 74-75, March 1986.

Descriptors: *Giardia cysts, *Filtration, *Spring water, *Oregon, Turbidity, Small-scale systems, Water treatment.

Water from a natural spring at the Van Duzer Forest Corridor State Wayside, Lincoln County, Oregon, is filtered by using a 12-in diameter plate and frame industrial style filter. In addition to removing Giardia cysts, the 1 micrometer filtration removed small animal and miscellaneous detritus. The treatment equipment uses 30 discs, and all contact parts are stainless steel. It has performed successfully for 6 yr with a vigorous maintenance program. Filter media are changed whenever turbidity (checked daily) reaches 1.0 NTU. The process of changing filters and cleaning the equipment and other media available for this type of filter are described. The authors suggest that this type of filtration would be very useful in other parks, small water districts, and municipalities, and other places where high-quality but relatively inexpensive water is required. (Rochester-PTT)
W86-04735

RIVER DEE SCHEME AND INTAKE PROTECTION SYSTEMS,
North West Water Authority, Warrington (England).
J. N. Rushbrooke, and F. Beaumont.
Institution of Water Engineers and Scientists, Journal, Vol. 40, No. 2, p 173-192, April 1986. 7 fig, 7 ref.

Descriptors: *River Dee, *Taste, *Monitoring, *Communications, *Intake protection, United Kingdom, Pollutants.

Improvements that have been made in the River Dee (United Kingdom) systems since a 1984 pollution incident involving chlorophenolic taste are described. The historical background of taste complaints, the River Dee working group, including the monitoring task group, communications task group, and communications, monitoring and training procedures, and intake protection stations (Mobile intake protection station, Huntington intake protection station, and permanent intake protection systems) are described. The systems developed since the 1984 phenol incident have ensured that no contaminated water has been delivered to the consumer. The installation and commissioning of the automatic and remote monitoring equipment, the provision of additional analytical facilities, the improvements to communications, and cooperative efforts proved successful in dealing with pollution incidents in early 1985. (Rochester-PTT)
W86-04752

CROSS SOLENT WATERMAIN,
Southern Water Authority, St. Leonards (England).
F. N. Midmer.
Institution of Water Engineers and Scientists, Journal, Vol. 40, No. 2, p 193-200, April 1986. 3 fig, 10 ref.

Descriptors: *Water mains, *Isle of Wight, *Peak demand, Seasonal variation, Cost analysis, United Kingdom, Cross Solent Watermain, Construction, Feasibility studies.

The Solent crossing watermain was intended to relieve a problem of water shortages on the Isle of Wight, United Kingdom. The project included studies of feasibility, design characteristics, construction, cost, performance, and upgrading. The original Cross Solent supply was completed in 1980, with a capacity of 10 million liter/day, and at a cost of 2,530,000 pounds Sterling, 12.5% above the original project estimate of November 1978. For two years the line was used for base supply of 5 million liter/day in winter and peak supply of 10 million liter/day in summer. In 1982/1983 an additional 100,000 pounds Sterling was expended for pumping equipment to allow temporary increases of flow up to 15 million liter/day to meet peak demands. (Rochester-PTT)
W86-04753

INFORMATIONAL/EDUCATIONAL APPROACHES TO PUBLIC ATTITUDES ON POTABLE REUSE OF WASTEWATER,
Denver Research Inst., CO.
For primary bibliographic entry see Field 5D.
W86-04827

DRINKING WATER COST EQUATIONS,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
P. Dorsey, and R. M. Clark.
Available from the National Technical Information Service, Springfield, VA. 22161, as PB83-181826, Price codes: A09 in paper, A01 in microfiche. Report EPA-600/2-82-055, December 1982. 147 p, 6 fig, 14 tab, 8 ref, 2 append.

Descriptors: *Drinking water, *Cost analysis, *Economic evaluation, *Water treatment, Economic aspects, Statistical analysis.

This report presents capital, and operating and maintenance cost equations for 99 water treatment unit processes. The equations, derived from a cost data base developed from the Drinking Water Research Division can be used to provide preliminary cost estimates from individual unit processes or for entire trains. Methodology used for deriving the equations, an explanation as to how the equations were developed, equation testing, possible uses, and examples of their application are presented in this report. A computer program has been developed to encourage use of these equations. (Author's abstract)
W86-04942

USES OF OZONE IN WATER TREATMENT – A REVIEW,
Water Research Centre, Stevenage (England).
R. A. Hyde, and T. F. Zabel.
Effluent and Water Treatment Journal, Vol. 26, No. 3/4, p 121-125, March/April 1986. 1 tab, 4 fig, 10 ref.

Descriptors: *Water treatment, *Ozone, *Potable water, Disinfection, Taste, Color, Organics, Iron, Manganese, Turbidity, Algae.

The uses of ozone in water treatment are reviewed. In general an ozone plant consists of a gas preparation plant, an ozone generator, an ozone-water contacting stage and an ozone off-gas destruction device. The gas required for the production of ozone must have a very low humidity because moisture in the feed gas reduces the amount of ozone produced per unit power input and increases maintenance costs. The gas should also be oil free. An ozone generator element consists of two electrodes separated by an air space and a glass dielectric layer. An efficient cooling system must be provided to minimize decomposition of the ozone, to achieve maximum efficiency to the ozonizer and to prevent damage to the dielectric. For the ozone to be effective it must be dissolved in the water and sufficient contact time (5 to 10 min) must be allowed for the ozone to react. Ozone is a powerful oxidant and it can be applied for many different treatment problems: disinfection, taste and odor control, color removal, organic removal, iron and manganese removal, algal removal, and turbidity removal. To avoid problems in distribution it is important that the ozone is applied at the correct stage in the treatment process. The benefits and costs of ozone must be compared with those of alternative oxidants or processes. (Peters-PTT)
W86-04955

WATER AND WASTEWATER TIME TO AUTOMATE,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div.
For primary bibliographic entry see Field 5G.
W86-04958

REACTIVITY OF NITROGENOUS AND OTHER ORGANIC COMPOUNDS WITH AQUEOUS CHLORINE,
Environmental Protection Agency, Cincinnati, OH. Microbiological Treatment Branch.
E. L. Katz.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 36, No. 5, p 715-722, May 1986. 1 tab, 21 ref.

Descriptors: *Chlorine, *Organic compounds, *Water treatment, Amino acids, Phenoxy acid, Pyridine, Amides, Amines, Phenols, Aliphatic hydrocarbons, Aromatic compounds, Pesticides, Chlorinated hydrocarbons.

A protocol is proposed for the testing and systematic classification of organic compounds (phenolics, chlorinated hydrocarbons/pesticides, amides, quinolines, imides, pyrimidines, aliphatics, indoles, sugars, amines, pyrrole compounds, amino acids, polynuclear aromatics, pyridines) as to their reactivity to chlorine. The ratios and concentrations are such that could be expected to occur in water treatment. By use of the generalizations formulated, some predictions as to reactions of organics in the chlorination process can be derived. In 90% of the cases studied, there were no, or only slight, effects of pH on Cl concentrations in the establishment of reactivity categories. Amino acids, phenolics, organic sulfur compounds, pyrroles, prolines and indoles were very reactive. Xanthines varied depending upon other functional groupings in the structure. Other compounds tested showed little or no reactivity in these tests. An important thrust of this study is that the compounds tested can serve as models for treatability problems that may confront utilities. (Peters-PTT)
W86-04960

SHORTAGE OF WATER FLUORIDATION CHEMICALS DEVELOPING,
D. Webber.
Chemical and Engineering News CENEAR, Vol. 64, No. 7, p 20-21, February 17, 1986. 1 fig.

Descriptors: *Fluoridation, *Municipal water, *Water treatment, *Chemical shortage, Hydrofluosilicic acid, Sodium silicofluoride, Sodium fluoride, Tooth decay, Phosphoric acid, Fertilizer, Farm crisis, Economics, Policy making.

Municipal programs to treat tooth decay through fluoridation of water are suffering due to a shortage of fluoridation chemicals. This problem has developed as a consequence of the farm crisis, because the three major fluoridation compounds, hydrofluosilicic acid (HFSA), sodium silicofluoride, and sodium fluoride, are made largely as by-products of phosphoric acid production for fertilizer. Because of excess fertilizer inventories, production has been essentially halted. Total capacity is more than adequate to supply all other HFSA needed in the United States, both for municipal water systems and the aluminum industry, the other major consumer. The problem is not total supply but periodic gaps in production coupled with a lack of storage capacity. In addition to causing problems for communities already fluoridating their water, the periodic shortages sometimes give communities where fluoridation is a controversial issue an excuse to drop fluoridation entirely. (Rochester-PTT)
W86-04976

ESTIMATING RISK TO HUMAN HEALTH,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
For primary bibliographic entry see Field 5B.
W86-04977

VIRUSES IN DRINKING WATER,
Environmental Protection Agency, Cincinnati, OH.
G. Bitton, S. R. Farrah, C. L. Montague, and E. W. Akin.
Environmental Science and Technology ESTHAG, Vol. 20, No. 3, p 216-222, March 1986. 84 ref. EPA Contract Agreement 68-03-3196.

Descriptors: *Viruses, *Drinking water, *Standards, *Water treatment, Water softening, Charged filters, Microorganisms, Coagulation, Sand filters,

Epidemiology, Aluminum salts, Iron salts, Cationic polyelectrolytes, Chemical flocculation, Lime, Soda ash, Cost analysis.

Available literature on the monitoring in drinking water is reviewed and detection methods indicators, the effects of water treatment processes on virus removal, and the epidemiological significance of viruses in drinking water are discussed. Viruses in drinking water are rare in developed countries where water is treated adequately, but are found in unchlorinated water that is consumed without treatment. To detect viruses, relatively large amounts of water (100 liters or more) need to be concentrated. The most commonly used procedure is based on the adsorption of viruses to negatively charged filters (Balston, Cox, or Filterite) or to positively charged filters (Zeta+ and Virosorb 1-MDS). There have been numerous debates concerning the usefulness of certain microorganisms as indicators of viral presence. The presence of surrogates often indicates the presence of viruses, but their absence does not ensure the absence of viruses. Coagulation with aluminum and iron salts, if properly conducted, can achieve >99% removal of viruses. The efficiency of the coagulation-sedimentation processes can be improved by the addition of coagulant aids such as cationic polyelectrolytes. Slow sand filtration is more effective than rapid sand filtration. The efficiency of rapid sand filtration can be improved when filtration is preceded by chemical flocculation. In water-softening plants, the lime-soda ash process achieves better than 99.9% virus removal. It is too soon to establish standards for viruses in drinking water, and the cost involved in implementing such standards would override any potential benefits. (Rochester-PTT)
W86-04978

ADSORPTION OF ORGANIC POLLUTANTS ON MONTMORILLONITE TREATED WITH AMINES,
Iowa State Univ., Ames. Dept. of Civil Engineering.
T. A. Wolfe, T. Demirel, and E. R. Baumann.
Journal of the Water Pollution Control Federation, Vol. 58, No. 1, p 68-76, January 1986. 4 fig, 5 tab, 24 ref.

Descriptors: *Clays, *Adsorbents, *Organic compounds, *Montmorillonite, *Bentonite, *Sedimentation basins, *Priority pollutants, *Water treatment, *Wastewater treatment, X-ray diffraction, Thermal analysis, Thermogravimetric analysis, Infrared spectroscopy, Scanning electron microscopy, Adsorption isotherms.

X-ray diffraction analysis, differential thermal and thermogravimetric analyses, infrared spectroscopy, and scanning electron microscopy were used to determine the initial interactions between montmorillonite and the three alkylammonium salts. Adsorption isotherms were performed with these alkylammonium montmorillonites and aqueous solutions of 11 organic pollutants representing various chemical classes of priority pollutants. Four major categories of procedures were performed: (1) separation of the sodium montmorillonite clay fraction from Wyoming bentonite by centrifugation; (2) exchanged of the sodium ions in montmorillonite with hydrochloride salts of three amines; (3) x-ray diffraction studies of the interactions between aqueous mixtures of the organic pollutants and alkylammonium bentonites over a wide concentration range; and (4) determination of adsorption isotherms for the organic pollutants. It is suggested that, in practice, alkylammonium clays could be added to a sedimentation basin, kept in suspension for a period sufficient to permit adsorption to occur, and then settle from solution. Propylammonium montmorillonite was the best adsorbent, at low organic concentrations, whereas dodecylammonium bentonite was able to intercalate the pollutants the best at higher organic concentrations. There seems to be promise for the use of clays (especially smectites) as adsorbents in water and wastewater treatment. (Rochester-PTT)
W86-05022

EFFECTS OF NON-IDEAL COMPETITION ON MULTI-COMPONENT ADSORPTION EQUILIBRIA,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
D. R. Yonge, and T. M. Keinath.
Journal of the Water Pollution Control Federation, Vol. 58, No. 1, p 77-81, January 1986. 3 fig, 5 tab, 25 ref.

Descriptors: *Adsorption isotherms, *Adsorption equilibria, *Activated carbon, *Water treatment, *Wastewater treatment, Mathematical models, Phenols, O-cresol, Feundlich equation, Static bottle test procedure.

Single-solute adsorption isotherms were developed using the static bottle test procedure for the following sorbates: phenol, 2-ethylphenol, o-cresol, o-methoxyphenol, and 4-isopropylphenol. To obtain information on non-ideal competition for adsorption sites, solutions containing pairs of sorbates with equilibrated with granular activated carbon in continuous-flow columns. The simultaneous sorbate addition data indicate that significant improvements in model predictability result from the addition of a competition factor to the simplified ideal adsorbed solution model. A term associated with the low solubility (eta sub 1) of a sorbate pair was not significant. Conversely, the term associated with the higher solubility sorbate (eta sub 2) resulted in a significant improvement in data description. This was accomplished by decreasing the value of K (Freundlich equation constant) associated with this sorbate and thereby decreasing its predicted degree of competitiveness. Competition factor values corresponded reasonably well with a solubility parameter for this as well as other data, making the model reasonably predictive. (Rochester-PTT)
W86-05023

MONITORING SEBAGO LAKE WATER QUALITY BELOW THE THERMOCLINE,
Portland Water District, ME.
R. P. Grady, and P. G. Boissonneault.
Journal of the New England Water Works Association, Vol. 100, No. 1, p 44-67, March 1986. 12 fig, 1 tab.

Descriptors: *Thermocline, *Sebago Lake, *Maine, *Water quality management, *Algae, *Aesthetics, *Diatoms, Intake depth, Temperature, Turbidity, Bacteria, Drinking water, Cost analysis, Hydrogen ion concentration, Physical properties, Biological properties.

A four-season study has shown that water taken from a point 85 ft deep in Sebago Lake, Maine, differs in many ways from water taken from a point 25 ft deep. These differences were primarily related to physical and biological factors, including temperature, turbidity, pH, algae counts, bacterial counts, and silting index. Chemical differences were important only in relationship to the physical and biological changes they effect. The differences measured indicated that the deep water is more desirable as a drinking water source and is likely to remain so for a long time. Aesthetic problems that have occurred with the present shallow-water source are unlikely to occur with the use of deep water. The severe aesthetic problems resulting from diatom agglomeration have never occurred when algae count numbers are at the levels found in deep water. Changing the depth of the intake appears to be desirable, and would have the same value even if more extensive treatment were required in the future. At present, this action permits a significant upgrading of water quality at a fraction of the capital cost of treatment processes, while avoiding any operating cost and incurring a very minor maintenance cost. (Rochester-PTT)
W86-05027

BIODEGRADABILITY AND GAC ADSORBABILITY OF MICROPOLLUTANTS BY PREOZONATION,
Kyoto Univ. (Japan). Dept. of Sanitary Engineering.
I. Somiya, H. Yamada, E. Nozawa, and M. Mohri.
Ozone, Vol. 8, No. 1, p 11-26, 1986. 1 tab, 15 fig.

Descriptors: *Water treatment, *Biodegradation, *Ozone, *Humic acids, *Activated carbon, Micropollutants, Equilibrium concentration, Filters, Activated sludge.

The biodegradability and GAC adsorbability of two ozonated humic acids are discussed based on the data obtained by two kinds of experiments. The biological activated carbon (BAC) performance and the characteristics of removal mechanisms on BAC were analyzed. In batch test, the biodegradability of humic acid was improved remarkably by preozonation, but the equilibrium adsorption constant k, at equilibrium concentration c sub e = 1.0 mg/liter was not effectively improved. Some organics which are hard to adsorb on granulated activated carbon (GAC) seem to be produced. The decomposition rates of ozonated humic acid were measured by respirometers. The rate constant for microbes inoculated on GAC are in the same order as those of activated sludge. When microbes can utilize both adsorbed and soluble substrates simultaneously, the oxygen consumption is raised at the beginning of the reaction time by a few times the rate constants calculated from the data on each substrate. In continuous tests on BAC and GAC filters, the breakthrough time was distinctly prolonged on the BAC filter compared to the GAC filter, and also by preozonation. The adsorbability of ozonated humic acid on GAC is expressed by the overall transfer coefficient k sub L a, which is improved by preozonation. The value of k sub L a on BAC is estimated to be twice or three times that on GAC with respect to the sample at the same ozonation intensity. (Peters-PTT)
W86-05040

OZONIZATION OF HUMIC ACIDS. MEDIUM TERM TOXICITY TOWARDS DAPHNIA MAGNA,
Lille-2 Univ. (France). Unit of Pharmacy.
For primary bibliographic entry see Field 5C.
W86-05041

NEW YORK CITY'S OZONE DEMONSTRATION PLANT DESIGN,
Hazen and Sawyer, New York.
A. J. Varas.
Ozone, Vol 8, No. 1, p 49-62, 1986. 6 fig, 1 ref.

Descriptors: *Ozone, *New York, *Water treatment, Jerome Park Reservoir, Water quality, Turbidity, Iron, Manganese, Ozonation, Filtration.

Design and construction specifications of a 3 mgd (12,187 cu m/day) demonstration plant to treat water by ozonation followed by diatomaceous earth (DE) filtration at New York City's Jerome Park Reservoir are described. Population growth and changes in land use on the Croton watershed have contributed to a deterioration of the quality of Croton water. As a result, New York City and State health agencies have agreed upon the need for a water treatment plant for this, the oldest New York City supply. The primary treatment objectives are to maintain a treated water quality of turbidity below 0.2 NTU, color below 3 color units, and iron and manganese below 0.3 mg/liter. Three process trains will be employed, each operating at a maximum of 1 mgd (3,786 cu m/day), to test various modifications of the ozone/DE process. The demonstration plant is scheduled to operate approximately one year, beginning in April 1986, to provide data for a full-scale plant to be constructed later in the decade. The average ozone requirements will be approximately 2,000 lbs/day (900 kg/day) with a probable installed capacity of 4,000 lbs/day (1,800 kg/day). (Peters-PTT)
W86-05042

BROMOFORM FORMATION IN OZONATED GROUNDWATER CONTAINING BROMIDE AND HUMIC SUBSTANCES,
Florida International Univ., Miami. Drinking Water Quality Research Center.
W. J. Cooper, G. L. Amy, C. A. Moore, and R. G. Zika.
Ozone, Vol. 8, No. 1, p 63-76, 1986. 1 tab, 6 fig, 7 ref.

Descriptors: *Water treatment, *Groundwater, *Humic acids, *Ozone, Bromoform, Bromide, Water treatment, Biscayne aquifer, Hydrogen ion concentrations, Halogens.

The effects of organic carbon concentration, bromide ion concentration, pH, and solar irradiation on the formation of bromoform in ozonated waters derived from four unique samples taken from different regions of the Biscayne Aquifer are presented. This groundwater system serves as the principal source of drinking water in south Florida, and contains high levels of aquatic humic substances (DOC 5 to 20 mg/liter) and moderate levels of bromide ion (150-250 micrograms/liter). Increases in bromide ion concentrations resulted in increases in bromoform formation. In 3 of the 4 samples, bromoform formation decreased as the pH level increased from 5 to 9. The fourth sample exhibited an opposite trend, bromoform concentration increased with increasing 03 concentration over an ozone dosage range of 3.4 to 6.7 mg/liter. Ozonated samples placed in sunlight immediately after ozone addition showed a decrease in the formation of bromoform, presumably due to the photodecomposition of HOBr/OBr(3). This research has important implications for water treatment practice. The ozonation of waters containing bromide ion and humic substances can lead to the formation of trihalomethanes in the form of bromoform. Although it is unlikely that the current EPA maximum contaminant level of 100 microgram/liter will be exceeded, bromoform levels of 10 to 20 microgram/liter may be formed under some water treatment conditions. (Peters-PTT)
W86-05043

OZONATION AT THE 900 CFS LOS ANGELES WATER PURIFICATION PLANT,
Camp, Dresser and McKee, Inc., Boston, MA.
P. W. Prendiville.
Ozone, Vol. 8, No. 1, p 77-93, 1986. 10 fig, 6 ref.

Descriptors: *Water treatment, *Ozone, *Los Angeles, California, Safe Drinking Water Act, Turbidity, Owens River, Aqueducts, Trihalomethanes, Microflocculation, Ozonation, Chlorination.

In 1979, the California Safe Drinking Water Act established a new turbidity limit of 0.5 turbidity unit for drinking waters. The Los Angeles Department of Water and Power (LADWP) began a series of studies to determine the most effective and economical method of bringing Owens River Aqueduct water into compliance with the new standards. The LADWP selected the joint venture of Brown and Caldwell and Camp Dresser & McKee in 1980 to conduct additional pilot plant tests, design the filtration plant, and provide consulting services during construction and initial operation of the plant. To meet the new standard at the Owens River Aqueduct plant, a process involving preozonation and direct filtration was tested and selected. In addition to providing water which meets the required turbidity standard, the ozone process reduces trihalomethane levels by about 50%, allows filtration rates of 15 gpm/sq ft, reduces coagulation requirements, increases the removal of organics, thus reducing final chlorination requirements, reduces sludge quantities and subsequent sludge disposal costs, is a more effective bactericide and viricide than chlorine, and provides the most cost-effective reduction of levels of taste, odor, and color. The new Los Angeles water treatment plant is expected to be on-line in 1986. (Peters-PTT)
W86-05044

DISINFECTION FOR POTABLE REUSE,
Denver Water Dept., CO.
S. E. Rogers, and W. C. Lauer.
Journal of the Water Pollution Control Federation JWPFA, Vol. 58, No. 3, p 193-197, March 1986. 6 fig, 1 tab, 28 ref.

Descriptors: *Disinfection, *Water reuse, *Potable water, Denver, Multiple barrier design, Wastewater treatment, Public health, Municipal wastewater, Bioindicators, Enteroviruses, Lime, Ozone, Reversible osmosis, Chlorination, Drinking water.

A demonstration plant operated by the Denver, Colorado Water Department has produced water of lower bacterial count than potable water from first-use mountain run-off, demonstrating a large safety factor for public health protection in the direct reuse of secondary municipal wastewater. A t-test indicated that 6-month mean values were different at p=0.05 for both total coliforms and heterotrophic plate count. The plant uses a multiple barrier design to ensure that no single process is wholly responsible for the removal of any single contaminant. The treatment train consists of 12 major steps involving 21 interrelated unit processes including lime treatment, ozone, reverse osmosis, and chlorine dioxide disinfection. Bacterial indicator and coliphage levels were significantly lower in reuse product water than in Denver drinking water. Future studies will include the analysis of additional pathogenic organisms and enteric viruses. Projections show that, in the future, treatment of wastewater effluent to potable quality will become economically competitive with the development of new supplies. (Doria-PTT)
W86-05048

BLAST FURNACE RECYCLE WATER QUALITY AND REACTIONS OF LEAD AND ZINC,
Carnegie-Mellon Univ., Pittsburgh, PA. Dept. of Civil Engineering.
R. G. Luthy, E. R. Sable, and F. C. McMichael.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 3, p 250-260, March 1986. 9 fig, 6 tab, 46 ref. EPA Grant No. R809628.

Descriptors: *Recycling, *Wastewater treatment, *Water analysis, *Water quality control, *Zinc, *Lead, Industrial water, Equilibrium, *Water reuse, Chemical analysis, Model studies, Carbon dioxide, Chemical reactions, Solids.

The purpose of this investigation was to characterize blast furnace gas (BFG) recycle scrubber water to enhance the chemical knowledge of these systems. The work was directed toward understanding the water quality and equilibrium conditions in the recycle system, including lead and zinc solid-liquid partitioning and adsorption on suspended solids. Chemical modeling showed that CO2 chemistry in the recycle water fluctuates between that for a closed system in the scrubber and that for an open system in the cooling tower, and approaches equilibrium with atmospheric CO2 to a greater extent than equilibrium with CO2 in the BFG. This seemed to be a result of sparging and spraying, as well as the larger residence time associated with process units open to the atmosphere versus that for units closed to the atmosphere. Two chemical equilibrium modeling approaches were used to evaluate recycle water chemical speciation and degree of supersaturation with respect to various solids. Both approaches indicated that the recycle water was supersaturated with CaCO3(s), and this justified the need for an organic phosphonate anticalant chemical treatment program. The solids in BFG recycle scrubber water were comprised of iron oxides, and lead and zinc were associated with the solid surface. Under acidic conditions lead and zinc were desorbed from the solid surface to approximately 50 and 230 mg/L, respectively, at 50 g/L solids. Metal desorption-adsorption studies with lead and zinc and solids at these same concentrations, showed characteristic pH-adsorption edges for these metals. The results showed that chemical modeling approaches can be used to describe some important chemical properties of these systems, which can lead to better operation for recycle and application of water treatment chemicals and to improved control of regulated constituents. (Lantz-PTT)
W86-05056

APPLICATION OF OZONE FOR WATER TREATMENT IN THE UNITED KINGDOM CURRENT PRACTICE AND RECENT RESEARCH,
Water Research Centre, Stevenage (England).
T. F. Zabel.
Ozone Science & Engineering, Vol. 7, No. 1, p 11-30, Winter 1985. 9 fig, 5 tab, 8 ref.

Descriptors: *Ozone, *Water treatment, *United Kingdom, *Ozonation, *Potable water, Treatment plants, Filtration, Activated carbon, Pretreatment of water, Organic carbon.

Although only two water works in the UK are currently using ozone treatment, concerns regarding trace organics in potable water have stimulated research into ozonation for enhancing organics removal on slow sand filters and by granular activated carbon. The most promising application for ozone seems to be in enhancing the performance of slow sand filters treating lowland surface waters. Pre-ozonation increased total organic carbon (TOC) removal by this system from 15% to 30%, and doubled the filter run length from about 50 to more than 100 days before the maximum head loss of 1 m was reached. Pre-ozonation provided relatively little enhancement in TOC removal on granular carbon independently, whether the carbon was operated after the slow sand filters or after conventional chemical treatment. Results are improved by increased empty bed contact time of the carbon and cessation of prechlorination. (Doria-PTT)
W86-05059

INFLUENCE OF WATER PREOZONATION ON THE CONSUMPTION OF OXIDANTS,
Societe Degremont, Rueil-Malmaison (France).
L. Brener, and Y. Richard.
Ozone Science & Engineering, Vol. 7, No. 2, p 137-154, Spring, 1985. 9 fig, 6 tab, 6 ref.

Descriptors: *Ozonation, *Ozone, *Oxidants, *Water treatment, Activated carbon, Chlorination, Pretreatment of water, Halomethanes, Organoleptic properties.

Some surface waters with high color or organic contents produce undesirable chlorinated derivatives when treated with chlorine. A pilot plant was set up to determine whether a treatment line combining clarification with preozonation followed by post-ozonation and filtration through activated carbon can produce a water having the same quality as that produced by an identical treatment line whose raw water has been prechlorinated. It was found that replacement of chlorine by ozone in preoxidation treatment would produce a water having a similar quality but without any halomethanes. Preozonation treatment also produced a decrease in the chlorine demand of the waters, and installation of a preozonation treatment will not lead to any excessive consumption of ozone. (Doria-PTT)
W86-05065

AUTOMATION OF A PLANT TREATING WATER WITH OZONE,
Societe Degremont, Rueil-Malmaison (France).
R. Louboutin.
Ozone Science & Engineering, Vol. 7, No. 2, p 155-165, Spring 1985. 7 fig, 5 ref.

Descriptors: *Ozone, *Automation, *Ozonation, Water treatment, Treatment plant design.

Total automation of a treatment plant in the city of Niort demonstrated how use of advanced automation techniques makes possible the optimization of investment and operating costs. Since total redundancy as regards both the ozone production plant itself and its automatic control system was not economically feasible, the plant was designed with two non-specialized ozone production lines and one single control unit. The chemical demand in oxidizing agent of the water is ensured in the first step of the process, and the viricidal action in a second step. Reliance on a single control unit is reasonable, since it may be considered the most reliable link of the whole treatment line because of the tremendous improvements brought by computerization. At the same time, detection and correction time of a failure in the programmable logic controller is so short that the constraint of operating the plant manually remains within totally reasonable limits. (Doria-PTT)
W86-05066

BENCH TESTING OF ON-LINE TOTAL RESIDUAL CHLORINE ANALYZERS,

Canviro Consultants Ltd., Kitchener (Ontario).
For primary bibliographic entry see Field 5A.
W86-05069

WATER AND NEPAL,
For primary bibliographic entry see Field 5C.
W86-05075

WATER RESOURCE AND SUPPLY DEVELOPMENT IN BRUNEI DARUSSALAM,
Watson Hawksley Asia, Brunei Darussalam.
R. G. Cole, and Y. A. Kamarulzaman.
Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 5, p 381-400, October 1985. 8 fig, 8 tab, 5 ref.

Descriptors: *Developing countries, *Brunei Darussalam, Water resources, *Water supply development, Well development, Resources development, Water conveyance, Groundwater potential, Saline water intrusion.

Infrastructure and building developments are rapidly expanding in Brunei Darussalam and additional water resource and supply schemes are needed. This paper describes existing and future water demands, the various resource and supply studies undertaken, and the development of urban and rural schemes. Particular reference is made to the vertical lift gate barrage across the River Belait and the Benutan reservoir for regulation of the Tutong. During 1977-1979, water resources studies were undertaken of (1) the hydrological aspects of the Tutong and Belait, (2) saline intrusion into the estuaries, including the develop,ment of a mathematical model to predict the circumstances under which saline water would reach existing intakes, and (3) aquifer characteristics for the identification of the basins having the best potential for groundwater development. A proposed new water treatment plant and transmission system are discussed as are water supply schemes for two rural areas, Labi and Temburong. Capital costs for the projects described are tabulated and total B $375 million. (Khumbatta-PTT)
W86-05078

SIMPLE METHOD OF CHIRONOMID CONTROL AT WATER TREATMENT WORKS,
Mid Kent Water Co., Canterbury (England).
T. Flynn, and P. M. Bolas.
Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 5, p 414-422, October 1985. 4 fig, 5 ref.

Descriptors: *Water treatment facilities, *Midges, *Insect control, Distribution systems, Surface water, Larvae.

Infestations of public water supply mains and distribution systems by Chironomid larvae, often known as 'bloodworms', are a relatively frequent problem experienced throughout the water industry when surface water is treated. Although probably of no public health significance, the larvae give rise to numerous complaints and considerable anxiety amongst consumers and the problem period is normally from August to October when the larvae reach sizes of 1 cm or more in length. In this study an entry to the supply was found to be from eggs laid in vulnerable parts of treatment plants. Newly hatched larvae then penetrated the filters. Raw water was not the primary source of infection. Protecting the filters and sedimentation tanks with simple horticultural water sprays offers a solution which prevents over 90 per cent of potential infestation. The method has scope for insect control at other sites, such as sewage works. (Khumbatta -PTT)
W86-05079

DESIGN OF RAPID SMALL-SCALE ADSORPTION TESTS FOR A CONSTANT DIFFUSIVITY,
Michigan Technological Univ., Houghton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-05135

RELATION BETWEEN DRINKING WATER NITRATE AND TOTAL NITRATE INTAKE,
Central Public Health Lab., London (England). Communicable Disease Surveillance Centre.
For primary bibliographic entry see Field 5G.
W86-05149

IMPLICATIONS OF HEAD LOSS PATH CHOICE IN THE OPTIMIZATION OF WATER DISTRIBUTION NETWORKS,
Manitoba Univ., Winnipeg. Dept. of Civil Engineering.
I. C. Goulter, B. M. Lussier, and D. R. Morgan.
Water Resources Research WRERAO, Vol. 22, No. 5, p 819-822, May 1986. 1 fig, 3 tab, 7 ref.

Descriptors: *Head loss, *Water distribution, *Optimization, Optimum development plans, Water supply systems, Water pressure, Flow rates, Flow characteristics.

The effects of varying the paths used to ensure adequate pressure throughout a water distribution network when using iterative linear programming-gradient search techniques for least cost solution of the network are analyzed. The final flows within links in a network appear to be dependent on the degree to which the links with which they are associated are included in the equations used to define pressures throughout the network. The more often a link is included, the larger the final flow is in that link. This condition results in networks which are designed on the basis of a single loading condition having an implied 'branched' nature defined, to a large extent, by the way in which the pressure constraints are formulated. (Lantz-PTT)
W86-05229

TREATMENT EFFICIENCY OF AN IMPROVED OZONATION UNIT APPLIED TO FISH CULTURE SITUATIONS,
Biologische Anstalt Helgoland (Germany, F.R.)
H. Rosenthal and, G. Kruner.
Ozone Science and Engineering, Vol. 7, No. 3, p 179-190, Summer, 1985. 7 fig, 1 tab, 28 ref.

Descriptors: *Ozonation, *Water reuse, *Fish farming, Efficiency, Nitrites, Ammonium, Biological oxygen demand.

In this study the oxidation rates for ammonium, nitrite, and BOD have been determined for each of these components separately or in combination, using an improved design of the contacting chamber. Two flow rates and three ozone concentrations were employed. Ammonia oxidation rates were slowest while nitrite and BOD removal was rapid. Ozone concentrations substantially influenced the oxidation rates for ammonium ion. Nitrate was oxidized equally rapidly under almost all operation conditions. Slight differences in oxidation rates were noted for both ammonia and nitrite as long as the BOD was high. (Lantz-PTT)
W86-05273

INFLUENCE OF TEMPERATURE ON BACTERIAL DEVELOPMENT IN WATERS,
Compagnie Intercommunale Bruxelloise des Eaux (Belgium).
G. Fransolet, G. Villers, and W. J. Masschelein.
Ozone Science and Engineering, Vol. 7, No. 3, p 205-227, Summer 1985. 13 fig, 7 tab, 23 ref.

Descriptors: *Bacteria, *Water treatment, *Water distribution, *Thermal effects, Ozonation, Pseudomonas, Azobacter, Bacillus, *Water pollution control, Corynebacter, Micorcoccus, Vibrionaceae, Enterobacter, Water temperature.

Microbial stability in water mains has become an increasing problem for waterworks where more surface water is used to meet distribution requirements. Even when surface water is treated appropriately, it usually contains a higher amount of organic compounds than groundwater, and during certain periods, can attain temperatures between 20 and 25 C. Furthermore, ozonation applied during treatment modifies structures of the dissolved organic materials. Six typical strains were used to determine the importance of the temperature factor on aftergrowth in five different types of water. Three criteria for the evaluation of aftergrowth are: the growth rate factor (r2), the growth yield (maximum number of germs/mL when growth stops), and the latency time. It was established that aftergrowth is related to the Pseudomonas and Azobacter families, and the species Bacillus, Corynebacter, Micrococcus, Vibrionaceae, and even Enterobacter. The temperature factor is most important in all aspects, as an increase in water temperature enhances all growth characteristics. (Main-PTT)
W86-05275

DETERMINATION OF CARBONATE TRACES IN HIGH-PURITY WATER BY MEANS OF CHROMATOGRAPHY,
Gesamthochschule Paderborn (Germany, F.R.). Fachbereich Chemie und Chemietechnik.
G. Brandt, G. Matuschek, and A. Kettrup.
Fresenius Zeitschrift Analylische Chemie, Vol. 321, No. 7, p 653-654, August 1985. 5 fig, 6 ref.

Descriptors: *Trace levels, *Carbonates, *Ion chromatography, Water quality control, Water treatment, Ion exchange, Water analysis.

The determination of bicarbonate in high-purity water applying ion-chromatography with indirect UV-detection is described. The results have been obtained using a low-capacity analytical ion-exchange column and eluents containing very pure weak organic acids. By direct injection of the sample concentration levels lower than 0.02 mg/l CO(2-)3 have been detected. (Author's abstract)
W86-05281

TREATMENT, WASTE MANAGEMENT AND COST FOR REMOVAL OF RADIOACTIVITY FROM DRINKING WATER,
Oklahoma Univ., Norman. Bureau of Water and Environmental Resources Research.
G. W. Reid, P. Lassovszky, and S. Hathaway.
Health Physics,Vol. 48,No. 5, p 671-694, May, 1985. 7 fig, 16 tab, 34 ref.

Descriptors: *Waste treatment, *Drinking water, *Water quality control, Radioactive waste disposal, Wastewater treatment, Reverse osmosis, Activated carbon, Adsorption, Coagulation, Electrodialysis, Chemical precipitation, Aeration, Ion exchange.

The processes used in treating drinking water for removal of radioactive contaminants and the disposal of wastes generated by the treatment processes are analyzed and discussed. The study was limited to U, Ra and Rn. Techniques discussed for the removal of radioactivity were: (1) cation exchange, (2) reverse osmosis, (3) lime softening, (4) adsorption processes, (5) DOW radium selective complexer (RSC), (6) anion exchange, (7) direct precipitation, (8) coagulation, (9) electrodialysis, (10) granualr activated carbon, and (11) aeration. The costs involved with each of the techniques are summarized along with each of the techniques are summarized along with informational needs which still remain unaddressed. (Lantz-PTT)
W86-05282

OZONE ABSORPTION WITH REACTION IN BENZESULFONIC ACID AQUEOUS SOLUTIONS,
Naples Univ. (Italy). Ist. di Chimica Industriale e Impianti Chemici.
G. Anselmi, P. G. Lignola, C. Raitano, and G. Volpicelli.
Chemical Engineering Science CESEAC, Vol. 40, No. 7, p 1033-1040, July 1985. 10 fig, 3 tab, 13 ref.

Descriptors: *Ozonation, *Chemical treatment, *Water treatment, *Benzensulfonic acid, Water treatment, Organic acids, Oxidation, Organic matter, Ultra-violet spectrophotometry.

The aim of this research, was to assess organic compound reactivity with ozone in aqueous media, and to evaluate the feasibility of oxidative degradation of traces of organic compounds in water, by

ozonized oxygen or air. Benzensulfonic acid (BSA) was chosen as representative of aryl sulfonates which constitute an important class of water pollutants owing to the widespread use of synthetic detergents. The methods of absorption with reaction, were used for the successful development of an 'ab initio' model of the oxidation of BSA aqueous solutions by ozonation. The predictive capability of the model was tested experimentally by means of an ultraviolet spectrophotometry technique. The accordance between experimental time evolution of species and that predicted by the model indirectly confirmed that the correlation for mass transfer and the kinetics were correct. (Masters-PTT)
W86-05284

TREATMENT OF AN IN-SITU OIL-SHALE RETORT WATER,
University of Wyoming Research Corp., Laramie. Western Research Inst.
D. J. Kocornik, W. F. McTernan, and S. L. Williams.
Environmental Progress, Vol. 4, No. 3, p 145-150, August 1985. 4 fig, 7 tab, 20 ref.

Descriptors: *Oil shale, *Industrial wastes, *Wastewater treatment, *Industrial wastes, Coagulation, Activated carbon, Absorbents, Green River, Sedimentation, Vernal, Utah, Pretreatment of water, Dissolved organic carbon.

The treatment of Green River formation oil shale retort water was studied in an experimental procedure whereby the effectiveness of coagulation-sedimentation and activated-carbon systems were evaluated. The specific retort water addressed here was Geokinetics-17, a product of a true in situ retort operated south of Vernal, Utah, in 1979. Seven primary coagulants - three inorganic salts and four synthetic organic polymers - and two commercially available activated carbons were used. It was concluded that coagulation-sedimentation was not an effective one-step treatment process on this water. Pretreatment by coagulation, followed by activated carbon treatment, did have an additive effect on total dissolved organic carbon removal and also increased the rate of absorption in batch systems, but did not affect the ultimate capacity of the carbon when evaluated in a batch mode. The dynamic granular carbon-untreated retort water system was rate limited by pore diffusion of the sorbate. (Masters-PTT)
W86-05285

ULTRAPURE WATER IN THE MICROELECTRONICS INDUSTRY,
Esmil Water Systems, Amsterdam (Netherlands).
H. M. Bunnik.
Effluent and Water Treatment Journal, Vol. 26, No. 1, p 23-25, January 1986. 3 fig, 3 tab.

Descriptors: *Ultrapure water, *Water treatment, *Water quality control, *Microelectronics, Filtration, Industrial water, Hamburg, West Germany, Drinking water, Sodium hypochlorite, Sand filters, Reverse osmosis, Citric acid.

Manufacturers of microelectronic devices require ultrapure water for rinsing at various stages in the fabrication process. An ultrapure water installation for 63 cu m/hr in the Hamburg factory of Valvo Roehren und Halbleiterwerke der Philips GmbH is described. The installation had to treat drinking water from the town of Hamburg. To isolate the installation from the drinking water system, three polyethylene break tanks with a content of 2 cu m each, were installed. Sodium hypochlorite was dosed to sterilize the break tank sand filters. For the prefiltration of the influent three manually operated sand filters were installed at a 28 cu m/hr capacity each. Sulfuric acid was used to neutralize the bicarbonate content of the raw water. For fine filtration, three cartridge filters were used. In addition, three high pressure pumps were added to increase the pressure to 40 bar for operation of the reverse osmosis units, and a flushing system was installed for cleaning. Citric acid was used for removing hardness scale, while iron hydroxide deposits were removed by oxalic acid, and bacterial fouling was prevented by routine sanitization using sodium hypochlorite. After the reverse osmosis unit (RO), a carbon dioxide degasser was installed on a horizontal permeate storage tank. Seven transfer pumps were installed in total and four horizontal storage tanks were made available for pure water. The operation of the installation was made fully automatic. In conclusion, the requirements for cleaner water are becoming more stringent and therefore RO units will be further improved in the future. (Master-PTT).)
W86-05288

LACK OF ASSOCIATION BETWEEN FLUORIDATION OF WATER AND CANCER,
M.D. Anderson Hospital and Tumor Inst., Houston, TX.
G. R. Newell, and M. V. Marshall.
Texas Medicine, Vol. 82, No. 2, p 48-50, February 1986. 2 tab, 23 ref.

Descriptors: *Fluoridation, *Cancer, Epidemiology, Water treatment, Drinking water.

Opponents to the fluoridation of drinking water supplies have claimed that fluoridation caused adverse health side effects, including cancer. There has probably been no human health issue more extensively evaluated for adverse medical outcomes with consistently negative results. No association between fluoridation of water and increased cancer death rates in consumers has been demonstrated. Fluoride at 1 ppm is not mutagenic in bacteria or human cells. No biochemical or biologic mechanism, whereby fluoride at 1 ppm causes cancer by genotoxic or epigenetic means, has been proposed. The time, effort, cost, and deprivation of preventive dental measures are incalculable. (McFarlane-PTT)
W86-05295

EVALUATION OF THE WATER SUPPLY AND SANITATION PROBLEMS IN NIGERIA,
Ibadan Univ. (Nigeria). Coll. of Medicine.
M. K. C. Sridhar, and M. A. Omishakin.
Royal Society of Health Journal, Vol. 105, No. 2, p 68-74, April 1985. 1 fig, 9 tab, 19 ref.

Descriptors: *Water supply, *Sanitation, *Nigeria, Water sources, Refuse disposal, Water associated diseases.

Water supply and sanitation problems before and after independence are analyzed and related to the prevalence of ten water associated diseases in different States in Nigeria. A few States showed maximum prevalence of these diseases. Rural migration, poor finances, Governmental apathy and strong cultural backgrounds in different ethnic groups have contributed to insufficient progress toward the goals of the water supply and sanitation decade. Community involvement, through health education and Government's involvement with the community at different stages of planning and implementation seem to yield the desired results. (Lantz-PTT)
W86-05300

CONTACT FLOCCULATION-FILTRATION OF LOW-TURBIDITY, HIGHLY COLOURED ACID MOORLAND WATER,
Sheffield City Polytechnic (England). Dept. of Civil Engineering.
B. A. Quaye, and N. P. Isaias.
Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 4, p 325-340, August 1985. 8 fig, 2 tab, 8 ref.

Descriptors: *Water treatment, *Flocculation, *Filtration, *Turbidity, *Color, *Acid water, *Moorland, Metal cations, Yorkshire, Suspended Solids, Iron, Manganese, Aluminum, Filter bed, Pilot scale, Potassium Permanganate, pH.

A contact flocculation-filtration process using a dual-media laboratory-scale apparatus, and a pilot-scale filter plant incorporating a steeply inclined settling tubes module as a flocculator, has confirmed that single-stage high-rate filtration of low turbidity, highly colored acid moorland water, can be an effective and economical alternative to conventional water treatment. A very high quality water, with low turbidity and very low levels of iron (0.05mg/l), manganese (0.03mg/l), aluminum (0.08mg/l) and color, was achieved at a filtration velocity of 15 m/hr which is treble the conventional filtration velocity. (McFarlane-PTT)
W86-05303

DISTRICT METERING,
Sunderland and South Shields Water Co. (England).
For primary bibliographic entry see Field 7B.
W86-05316

ECONOMIC APPRAISAL OF ACTIVE AND PASSIVE METHODS OF LEAKAGE CONTROL,
Mid Kent Water Co., Canterbury (England).
For primary bibliographic entry see Field 6C.
W86-05317

SOME DEVELOPMENTS IN PRESSURE REDUCTION,
Bristol Waterworks Co. (England).
For primary bibliographic entry see Field 8C.
W86-05318

SELECTING EFFECTIVE SOFTWARE FOR WATER AND WASTEWATER TREATMENT FACILITIES,
Engineering-Science, Inc., Atlanta, GA.
For primary bibliographic entry see Field 5D.
W86-05319

METHYL BROMIDE IN SURFACE DRINKING WATERS,
Azienda Comunale Elettricita ed Acque, Rome (Italy).
For primary bibliographic entry see Field 5A.
W86-05331

CHLORINE DIOXIDE REACTIVITY WITH PROTEINS,
University of South Florida, Tampa. Coll. of Public Health.
C. I. Noss, F. S. Hauchman, and V. P. Olivier.
Water Research, Vol. 20, No. 3, p 351-356, March 1986. 6 fig, 2 tab, 21 ref. EPA Contract R806074010.

Descriptors: *Disinfection, *Chlorine, *Viruses, Proteins, *Chlorine dioxide, *Water treatment, Amino acids, Escherichia coli, Disinfections.

Studies were conducted to evaluate chlorine dioxide reactivity with proteins and the role of these reactions in the inactivation of the bacterial virus f2 with chlorine dioxide. The effect of chlorine dioxide on the ability of f2 to specifically attach to its host Escherichia coli K13 was compared to the inactivation of virus during the initial seconds of contact time. At pH 7.2 and 5 degrees, the virus was rapidly inactivated with 0.6 mg/liter of chlorine dioxide. The loss of protein specific attachment function nearly paralleled intact virus inactivation with 1.2 log units of attachment inhibition occurring within 30 sec. The inactivation of virus and the inhibition of specific attachment both increased with increasing pH and disinfectant concentration. Inactivation of f2 was attributed to the reaction of chlorine dioxide with discrete chemical moieties in the viral protein. Cysteine, tyrosine and tryptophan reacted with chlorine dioxide within a time frame that could affect viral inactivation. In denatured f2 capsid protein monomers, these amino acids were almost totally degraded within 2 min by chlorine dioxide. Even though the degradation of tyrosine residues occurred at a much slower rate of virus inactivation, the protein component of f2 virus appeared to be the site of the lethal lesion produced by chlorine dioxide. These tyrosine reactions with chlorine dioxide appeared to alter the virus such that specific attachment was inhibited. (Geiger-PTT)
W86-05340

CHLORINE DIOXIDE REACTIVITY WITH NUCLEIC ACIDS,
North Carolina Univ. at Chapel Hill. School of Public Health.
F. S. Hauchman, C. I. Noss, and V. P. Olivieri.
Water Research, Vol. 20, No. 3, p 357-361, March 1986. 6 fig, 23 ref.

Descriptors: *Chlorine dioxide, *Nucleic acids, *Viruses, *Disinfection, *Water treatment, Disinfectants, Chlorine, Hydrogen ion concentration.

Studies were conducted with the bacterial virus f2 to determine the reactivity of chlorine dioxide with viral nucleic acid, and to evaluate the role of these reactions in the inactivation of virus with chlorine dioxide. The effect of chlorine dioxide on naked infectious RNA was compared to the inactivation of intact virus and to infectious f2 RNA extracted from virus which was treated with chlorine dioxide. At pH 7.2 and 5 degrees, greater than 4 log units of virus inactivation were observed within 2 min of contact time. Almost no inactivation of infectious RNA extracted from chlorine dioxide treated virus was observed. Treatment of naked infectious RNA with chlorine dioxide yielded less than 1 log unit of inactivation after 5 min of contact time. The rate of inactivation of both f2 virus and infectious RNA by chlorine dioxide increased with increasing pH. Inactivation of f2 infectious RNA was attributed to chlorine dioxide reactions with nucleotides. The reaction of chlorine dioxide within yeast RNA was uniquely associated with guanosine monophosphate (GMP). The reaction between chlorine dioxide and GMP may account for inactivation of naked f1 RNA. However, this reaction does not explain the inactivation of intact f2 virus, as the RNA within the treated virion remains infectious despite several log units of virus inactivation. (Author's abstract)
W86-05341

ALGAE REMOVAL BY FINE SAND/SILT FILTRATION,
Louisiana Dept. of Transportation and Development, Baton Rouge.
B. Naghavi, and R. F. Malone.
Water Research, Vol. 20, No. 3, p 377-383, March 1986. 6 fig, 2 tab, 21 ref.

Descriptors: *Wastewater treatment, *Filtration, *Sand filters, *Algal control, *Separation techniques, Silt, Nuisance algae, Clogging.

A laboratory scale study was undertaken to determine the potential of a method of filtering algae from water using fine sand/silt as the filter media. Five median sand sizes (0.064-0.335 mm) and four bed depths (3.175-12.700 mm) were examined in constant head experiments with the algae Scenedesmus quadricauda. A total of 46 experiments were conducted with continuous measurements of filtration rate, head loss and effluent quality. All media with median sand sizes at or below 0.200 mm gave consistently high algae removal rates. The average removal was 97.27% (based on fluorescence) with a low average initial head loss across the filter media of 7.3 cm (median grain size diameter of 0.200 mm with the bed depth of 3.175 mm). Initial filtration rates obtained in the experimental apparatus were as high as 226 cu m/sq m/day (3.84 gpm/sq ft), comparable to conventional sand units. Run times were short due to surface clogging of the media. No chemical addition was required to obtain high removal levels. (Author's abstract)
W86-05344

ALTERNATIVE ALUMINIUM FLOCCULANTS CONTROLLING MICROPOLLUTANTS,
Laporte Inorganics, Cheshire (England).
A. M. Simpson, W. Hatton, and A. Murray.
Effluent and Water Treatment Journal, Vol. 26, No. 1, p 9-15, January 1986. 1 fig, 7 tab, 22 ref.

Descriptors: *Pollutants, *Chlorination, *Water treatment, *Wastewater treatment, *Flocculation, *Dispersants, *Organic matter, *Micropollutants, *Aluminum, *Aluminum Sulfate, Chlorine, Polyaluminum Chloride Lapofloc, Lapofloc 2000, Trihalomethane.

Methods trying to minimize trihalomethane (THM) formation in dringing water are considered. One possible solution for the reductin of THMs resulting from chlorination is the prior removal of precursor organic acids. The advantages of flocculation prior to chlorination, the effect of flocculation on the removal of organic contaminants, and the effect of flocculation on the levels of heavy metals present in drinking water were investigated. Aluminum sulfate, Polyaluminum chloride Lapofloc (Lapofloc PAC) and Lapofloc 2000, were used as flocculants on water samples taken from three watersheds in England. Flocculatns were tested at their optimum doses for each raw water determined by their floc growth characteristics. In all cases Lapfloc PAC had the fastest growth, and as such was optimized at an overall lower dose than the other flocculants. Post-chlorination was advantageous in reducing the levels of THMs by means of aluminum flocculants removing humic and fulvic acids as measured by color removal to reduce the level of THM precursors. Aluminum sulfate produced the best overall color removal. The metal results were inconclusive. (Master-PTT)
W86-05404

ORGANIC MICROPOLLUTANTS AND THE PROTECTION OF WATER SUPPLIES,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
For primary bibliographic entry see Field 5B.
W86-05405

OCCURENCE OF RADIOACTIVITY IN PUBLIC WATER SUPPLIES IN THE UNITED STATES,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
For primary bibliographic entry see Field 5B.
W86-05407

5G. Water Quality Control

POWER FROM MINE COOLING WATER,
Foster-Miller, Inc., Waltham, MA.
For primary bibliographic entry see Field 8C.
W86-04703

DELINEATING ZONES OF CONTRIBUTION FOR PUBLIC SUPPLY WELLS TO PROTECT GROUND WATER IN NEW ENGLAND,
IEP, Inc., Barnstable, MA.
S. W. Horsley, and T. C. Cambareri.
Journal of the New England Water Works Association, Vol. 100, No. 1, p 19-43, March 1986. 15 fig, 11 ref.

Descriptors: *Zones of contribution, *Groundwater pollution, *Groundwater recharge, *Land use, *New England, Cape Code, Buried river valleys, Nitrate nitrogen, Multifamily dwellings, Herbicides, Regulations, Tertiary wastewater treatment, Glacial drift, Sand, Gravel, Clay.

This paper describes the procedures used to delineate zones of contribution to public water supply wells in two major geologic settings occurring in New England, the 'cape and islands' and the 'buried river valley', and discusses measures employed to protect water quality in those identified zones. The Cape and Islands region is comprised of sands, silts, clay, and gravel, whereas the buried river valleys contain thick deposits of stratified glacial drift enclosed in bedrock walls. Various schemes have been advanced for protecting groundwater within the zones of contribution defined by the methods described here. These include: prohibiting certain land uses, such as junkyards, landfills, and road salt stockpiles, from existing within the zone; upgrading residential zoning to large lots to limit the amount of nitrate-nitrogen entering the aquifer; requiring tertiary treatment for multifamily dwellings with nitrate-nitrogen loadings exceeding 24 lb/40,000 sq ft; passing regulations against herbicides within zones of contribution; and acquiring key parcels of land within zones of contribution so that sufficient clean recharge is available to dilute contaminated water from other land within the contribution zone. (Rochester-PTT)
W86-04705

DETERGENT PHOSPHATE BANS AND EUTROPHICATION,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
G. F. Lee, and R. A. Jones.
Environmental Science and Technology ESTHAG, Vol. 20, No. 4, p 330-331, April 1986. 1 fig, 1 tab, 8 ref.

Descriptors: *Water pollution control, *Detergents, *Phosphates, *Phosphorus removal, Eutrophication, Wastewater disposal, Domestic wastes.

The controversy over the value of detergent phosphate bans in improving water quality is discussed in relation to a recently-developed general relationship that can be used to evaluate the potential benefits of such a ban. The relationship is based on the finding that a reduction of approximately 20% in the P load to a water body must be achieved to yield a discernible effect on water quality. This 20% value is independent of the trophic state. It was developed from the P load-chlorophyll relationship developed in the Vollenweider-Organization for Economic Cooperation and Development eutrophication studies. Although detergent phosphate bans generally will not result in an overall improvement in water quality, there may be some situations in which eutrophication-related water quality would be improved by a ban. Such rare situations would be characterized by a high percentage of the water entering the water body being derived from domestic wastewaters and a substantial percentage of the phosphorus in the domestic wastewaters being derived from detergents. (Rochester-PTT)
W86-04719

POSSIBILITY OF MELIORATION AND AGRICULTURAL USE OF LIMAN AND MARINE SEDIMENTS,
Odessa Agricultural Inst. (USSR).
N. A. Kreyda, N. K. Lyadova, and T. Y. Arzumanyan.
Soviet Soil Science, Vol. 17, No. 5, p 66-71, September-October 1985. 4 tab. Translated from Pochvovedeniye, No. 7, p 75-80, 1985.

Descriptors: *Marine sediments, *Soil development, *Soil chemistry, Saline soils, Barley, Sunflower, Sorghum, Alfalfa, Sweet clover, Manure, Sodium ion, Shell detritus, Hydrogen ion concentration, Oxidation-reduction potential, Adsorbed cations.

Data on the changes in physicochemical properties (Eh, pH, adsorbed cations) and chemical composition (water-soluble salts and nutrients) of reclaimed soils on marine sediments, were used for cultivation experiments with barley, sorghum, alfalfa, sweet clover, and sunflower. It is concluded that, as a result of oxidation of the marine sediments, sodium ion activity decreased, the sediments became desolonetzified (spontaneous melioration due to shell detritus), and the pH decreased to neutral, but the supply of highly soluble salts did not decrease significantly due to the 'dry' winter of 1982-83, when the experiments were conducted. All the nutrients increased in the treatment to which manure was applied, and it was here that growth and development of all the crops was best. Barley and sunflower are recommended as pioneer crops. They should be planted on manured (80 metric tons/ha) marine sediments that have been dried to 40 cm, i.e., in the second year after transfer to dry land. (Rochester-PTT)
W86-04729

DRINKING WATER BILL SAILS THROUGH CONGRESS,
L. Ember.
Chemical and Engineering News CENEAR, Vol 64, No. 22, p 20, June 1986.

Descriptors: *Civil law, *Legislation, *Drinking water standards, Wellhead protection areas, Environmental protection, Public water systems, Pollutants, Groundwater protection, Well regulations, Regulations.

The 99th Congress passed a bill that strengthens the Safe Drinking Water Act. The conference bill passed the House May 13 by a vote of 382 to 21 and the Senate May 21 by a vote of 94 to 0. The bill authorizes vast increases in spending for drinking water programs through 1991. Groundwater protection is the major new thrust of revisions to the Drinking Water Act. In addition to issuing 83 new standards within three years, EPA is to assure through oversight and enforcement that states monitor their public water systems for contamination, including contamination by pollutants that are not regulated by EPA. States are to establish wellhead protection areas around public drinking water system wells. The bill authorizes spending of about $164 million per year from 1987 through 1991 to pay for the expanded drinking water programs. The bill has the support of the governors' association, environmental groups, and water supplier associations. (Peters-PTT)
W86-04766

FRESHWATER BIOLOGICAL MONITORING.
International Association on Water Pollution Research and Control, London (England).
For primary bibliographic entry see Field 5A.
W86-04767

BIOLOGICAL SURVEILLANCE IN WELSH RIVERS FOR WATER QUALITY AND CONSERVATION ASSESSMENT,
Welsh Water Authority, Gwent. Nash Area Lab.
For primary bibliographic entry see Field 5A.
W86-04770

MONITORING WATER QUANTITY AND WATER QUALITY IN AN URBAN BASIN,
For primary bibliographic entry see Field 7B.
W86-04807

REMEDIAL ACTION AT WASTE DISPOSAL SITES (REVISED): HANDBOOK.
Science Applications, Inc., McLean, VA.
For primary bibliographic entry see Field 5D.
W86-04820

METHODS TO ESTIMATE AQUATIC HABITAT VARIABLES.
Colorado Cooperative Fishery Research Unit, Fort Collins.
1984. 318 p, 55 fig, 23 tab, 93 ref, 8 append. Project No. DPTS-35-9.

Descriptors: *Aquatic environments, *Aquatic habitats, *Habitats, *Environment, Aquatic life, Aquatic plants, Aquatic weeds, Rivers, Stream fisheries, Streambeds.

Guidance for assessing the quality of aquatic habitats by measuring physico-chemical features is provided. Methodologies are provided for the following parameters: habitat area, cover, depth, discharge, dissolved oxygen, elevation, growing season, light, pH, pools, reservoir variables, salinity, streambank charcteristics, substrate, temperature, total dissolved solids, turbidity, velocity, and water-level fluctuation. The features, or variables, for which measurement methods are described, are those required by the Habitat Suitability Index models published by the United States Fish and Wildlife Service. (Halterman - PTT)
W86-04822

ELECTROPLATING INDUSTRY.
Centec Corp., Reston, VA.
For primary bibliographic entry see Field 5D.
W86-04823

LAKE RESTORATION: A FIVE-YEAR EVALUATION OF THE MIRROR AND SHADOW LAKE PROJECT WAUPACA, WISCONSIN,
Wisconsin Dept. of Natural Resources, Madison.
P. J. Garrison, and D. R. Knauer.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB83-176578, Price codes: A09 in paper, A01 in microfiche. Report EPA-600/3-83-010, March 1983. 100 p, 53 fig, 14 tab, 99 ref. Contract No. R804687-01.

Descriptors: *Lake restoration, *Eutrophication, *Evaluation, *Aluminum phosphate, Phosphorus, Storm sewers, Rehabitation, Diversion structures, Nitrogen, Algae, Mirror Lake, Shadow Lake, Wisconsin.

Mirror and Shadow Lakes, small seepage lakes in central Wisconsin, had experienced cultural eutrophication as a result of storm water drainage. Storm sewers were diverted from the lakes in 1976 and in 1978 aluminum sulfate was applied to enhance the recovery rate by reducing internal phosphorus loading from the sediments. Mirror Lake was artificially circulated to prevent low winter oxygen concentrations and increase spring oxygen concentrations. Storm sewer diversion reduced external phosphorus loading from 58-65 percent for both lakes while the aluminum sulfate application reduced inlake phosphorus concentrations from 90 mg/cu m and 55 mg/cm m in Mirror and Shadow Lakes respectively to 20-25 mg/cu m. Diversion of the storm sewers resulted in a decrease in epilimnetic phosphorus and nitrogen concentrations. Increased algal productivity and biovolume as a result of urban drainage after storm events were eliminated following storm sewer diversion. With the greatly reduced sediment phosphorus release following the alum treatment there was a decrease in spring algal community size and a shift from a community dominated by Oscillatoria agardhii var. to a more diverse community. Annual primary production was reduced 38 percent in Mirror Lake with the depth profiles shifting to those representative of mesotrophic lakes. Phosphorus and nitrogen sedimentation rates were reduced 55 percent and 28 percent respectively resulting in a decrease in the amount of these nutrients being recycled. The zooplankton community numerical size was reduced as the algal production declined. (Author's abstract)
W86-04939

OPPORTUNITIES FOR IMPROVING THE COST-EFFECTIVENESS OF ACID RAIN CONTROL STRATEGIES,
Argonne National Lab., IL. Energy and Environmental Systems Div.
D. G. Streets.
Environmental Progress, Vol. 5, No. 2, p 82-87, May 1986. 1 tab, 7 fig, 22 ref.

Descriptors: *Cost analysis, *Acid rain, *Legislation, Sikorsky-Waxman bill, Udall-Cheney bill, Sulfur, Adirondacks, Smokies, Coal mines, Public policy, Cost-benefit analysis.

None of the congressional bills proposed to control acid deposition can be considered a cost effective approach. Ways to improve spatial, temporal, and regulatory efficiency in choosing which emission sources to control are examined. Two kinds of cost-effective control strategy can be distinguished. Cost-optimized or least-cost seeks to reduce emissions wherever it is cheapest to do so. Sources are controlled in order of increasing marginal cost, until a desired level of emissions is reached. A second kind of cost-effective strategy, termed deposition-optimized or targeted, seeks to reduce emissions so as to reduce deposition at a particular receptor site at minimum cost. Sources are controlled on the basis of lowest cost and greatest contribution to deposition at the receptor site, until a desired deposition goal is reached. Both of these strategies can be distinguished from the legislative proposals, most of which may be termed emission-optimized strategies, in the sense that they seek to reduce emissions wherever emissions are greatest. No strategy is clearly the best from every standpoint. Those bills, such as Sikorski-Waxman, that attempt to preserve coal markets are very expensive. The cost-effective strategies, such as the Udall-Cheney bill, cause large disruptions in the coal industry. The deposition-optimized strategies are much cheaper but offer less widespread environmental protection. A workable strategy might be built around a targeted approach to control, limiting the reduction in emissions to a several-state region in the industrial Midwest and the Northeast. (Peters-PTT)
W86-04946

STEAM-REGENERATED ACTIVATED CARBON: AN EMISSION-FREE, COST-EFFECTIVE GROUND WATER TREATMENT PROCESS,
IT Corp., Knoxville, TN.
C. S. Parmele, R. D. Allan, and M. Mehran.
Environmental Progress, Vol. 5, No. 2, p 135-139, May 1986. 2 tab, 4 fig, 5 ref.

Descriptors: *Groundwater pollution, *Groundwater treatment, *Activated carbon, Carbon adsorption, Halogens, Aromatic compounds, Organics, Steam regeneration technology, Air stripping, Cost analysis, Ultraviolet radiation, Air pollution.

There is no universally applicable ground water treatment technology, but there are many site specific factors that influence the selection of the optimum ground water treatment process. Air stripping is frequently selected over carbon adsorption with virgin carbon for the removal of halogenated and aromatic solvents from contaminated ground water because it is the cheaper process when the volatilized organics can be emitted. However, increasing concern over the impact of the organics vented from an air stripping process has created a situation where ground water treatment costs will be significantly higher unless a cost-effective, emission-free treatment process can be developed. Steam regeneration technology is described and treatment costs are compared with those of several other treatment technologies. When the ground water flow required to clean up a site will be >100 gpm (6.3 L/s) for several years (which is frequently the case), a process using steam-regenerated activated carbon is an emission-free, cost-effective ground water treatment technology that should be considered. (Peters-PTT)
W86-04950

WATER AND WASTEWATER TIME TO AUTOMATE,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div.
D. F. Bishop, and W. Schuk.
Civil Engineering (ASCE), Vol. 56, No. 1, p 56-58, January 1986. 2 tab.

Descriptors: *Automation, *Wastewater treatment, *Water treatment, Monitoring, Control, Ohio River Sanitation Commission, Metro Seattle, Washington, Maintenance, Computers.

Water and wastewater engineers have been slow to adopt a full-circle systems approach to automated monitoring and control. Such a technical tactic for controlling water and wastewater distribution and collection would be efficient. Automated control technology is applied to some degree for managing gross contaminants and flows in most process applications and in water collection or distribution systems. A key deficiency in the centralized management of water treatment is the lack of a real-time link between raw water supply quality and treatment plant operation. Early warning systems such as those used by the Ohio River Sanitation Commission are monitoring massive toxic spills, these responses are manually activated and offer only limited protection. Complete automation of wastewater and water treatment networks would have far reaching implications for water quality control. Metro Seattle, Washington is working on an integrated network for treatment process control, lab automation and maintenance management. Other data transmission plans, such as the U.S. Geological Survey's satellite system, help bring integration of water quality control networks full circle. (Peters-PTT)
W86-04958

PHOTODEGRADATION OF THE HERBICIDE GLYPHOSATE IN WATER,

Norwegian Plant Protection Inst., Aas.
For primary bibliographic entry see Field 5D.
W86-04961

SANITARY LANDFILL LEACHATE RECYCLE,
New Jersey Inst. of Tech., Newark. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5E.
W86-04971

VIRUSES IN DRINKING WATER,
Environmental Protection Agency, Cincinnati, OH.
For primary bibliographic entry see Field 5F.
W86-04978

RAPID DETERMINATION OF CHEMICAL OXYGEN DEMAND IN WASTE WATERS AND EFFLUENTS BY FLOW INJECTION ANALYSIS,
Loughborough Univ. of Technology (England). Dept. of Chemistry.
J. M. H. Appleton, and J. F. Tyson.
Analytica Chimica Acta, Vol. 179, p 269-278, January 31, 1986. 2 tab, 6 fig, 7 ref.

Descriptors: *Chemical oxygen demand, *Effluents, *Water analysis, *Industrial wastewater, *Flow injection analysis, Peristaltic pump, Chemical wastewater, Brewery wastewater, Gas-works effluent, Cattle, Dye industry wastes.

In a proposed method for automated determination of chemical oxygen demand (COD) a reagent stream, containing potassium dichromate and sulfuric acid, is merged with a distilled water carrier into which samples are injected. After merging and while the stream flows through a suitable reactor, the sample is oxidized and Cr(VI) species in the reagent are reduced to CR(III). The absorbance of chromate is monitored at 445 nanometers. Reagent consumption is indicated by a transient negative departure from the steady-state absorption. Response is shown as the magnitude delta V of this negative peak. The results obtained with a processing time of 3 minutes are comparable with those given by the standard method for a wide range of effluent types (e.g., dye waste, brewery waste, cattle market waste). Agreement was achieved between the results for various standard materials. Mercury (II) is added to the sample to prevent chloride interference. Silver (I) catalyst can be incorporated into the reagent. A limitation to performance is caused by the maximum cycle time of 198 s of the analyzer. (Peters-PTT)
W86-04992

CONTROLLING TOXICITY: AN INTEGRATED STRATEGY,
K. B. Carter.
Journal of the Water Pollution Control Federation, Vol. 58, No. 1, p 6-11, January 1986.

Descriptors: *Environmental Protection Agency, *Surface water, *Groundwater, *Water pollution control, *Management planning, *Toxicity, *Monitoring, *Enforcement, Surrogate parameters, Effluents, Chemical-specific monitoring, State jurisdiction, Pollutant identification.

The problem of controlling toxic contamination in surface water and groundwater is discussed in relation to the recently published Environmental Protection Agency technical support document. This publication presents recommendations to regulatory authorities that cover every step in the process, from screening to compliance monitoring. Concepts in this document and toxicity-based pollution control in general are discussed under the following headings: whole-effluent monitoring, chemical-specific monitoring, limiting toxicity, exposure assessment, effluent screening, overall approach, and state responsibility. Central to a successful national program for control of toxic pollution of the nation's waters is an integration of approaches. A very important element in the EPA program is to consider toxicity itself as a constituent to be removed. Such surrogate parameters have been used before in environmental engineering, for example, in bioassay and the use of biochemical oxygen demand. This demonstrates that it is not necessary to know the identity of every toxic component of an effluent in order to mount a program to control it. (Rochester-PTT)
W86-05013

ORGANIC CONTAMINATION: WHISTLING PAST THE GRAVEYARD,
W. J. Weber, Jr.
Journal of the Water Pollution Control Federation, Vol. 58, No 1, p 12-17, January 1986. 2 tab.

Descriptors: *Water pollution control, *Water pollution sources, *Toxins, *Hazardous materials, *Policy making, *Public participation, *Organics, *Surface water, *Groundwater, Public policy, Liability, Risk assessment, Imports, Drinking water quality, Cost analysis.

Organic contamination issues embrace concerns ranging from management of cleanup disposal sites, through surface and groundwater pollution, to drinking water contamination. Weaknesses in the state of technical knowledge of toxic contamination and approaches for hazardous wastes are considered in the following areas: knowledge of the character and magnitude of hazardous waste issues and problems; the concept that problems of toxic and hazardous substances are geographically restricted to someone else's locality; the belief that land contaminant disposal provides adequate long-term solutions to toxic and hazardous waste management problems; making excuses for inaction on drinking water health risks on the grounds that the risks are small compared to those associated with smoking, driving, drinking, and other environmental health risks; knowledge of quantitative assessment of human and environmental risks of toxic and hazardous substances and about cost:benefit analysis; public information to influence decisions and policies; abandoning the responsibility for arbitration and resolution of conflicts to courts of law; the problem of strict national pollution control regulations versus imports from countries without such restrictions; excessive liabilities for participation in remedial programs and actions involving toxins and hazardous substances; inadequacy of current federal and state programs; and the need to improve drinking water quality and the costs of this effort. (Rochester-PTT)
W86-05014

DESIGN AND PERFORMANCE OF A GROUNDWATER TREATMENT SYSTEM FOR TOXIC ORGANIC REMOVAL,
CH2M Hill, Inc., Gainesville, FL. Hazardous Waste and Industrial Processes Div.
G. T. MacIntyre, N. N. Hatch, Jr, S. R. Gelman, and T. J. Peschman.
Journal of the Water Pollution Control Federation, Vol. 58, No. 1, p 41-46, January 1986. 8 fig, 4 tab, 6 ref.

Descriptors: *Toxins, *Organic compounds, *Groundwater, *On-site disposal, *Phosphate mining, *Solid waste, *Sludge, *Wastewater treatment, Florida, Grease, Oil, Septic waste, Scheduling, Wastewater facilities.

Successful design, construction, and operation of temporary treatment system is described. The facility was built at the Sydney Mine Waste Disposal site in Hillsborough County, Florida, where phosphate mining conducted during the 1930s and 1950s was followed in the 1970s by disposal of permitted solid waste and sludge disposal from grease trap, septic, and oil waste. Groundwater containment and recovery, treatment system design, construction, and performance, and on-site effluent disposal are described. The groundwater recovery, treatment, and disposal system has consistently and successfully removed toxic organics from the contaminated groundwater to below detectable limits. Time constraints were met in the project, permitting scheduled start-up of other remedial activities on schedule. (Rochester-PTT)
W86-05018

REAERATION RATE ESTIMATION USING THE LAG IN DISSOLVED OXYGEN CONCENTRATION,
Louisiana State Univ., Baton Rouge. Inst. for Environmental Studies.
For primary bibliographic entry see Field 2E.
W86-05060

GROUNDWATER PROTECTION STARTS BELOW THE SURFACE,
A. Snow.
American City & County, Vol. 100, No. 9, p 62, 64, 66, 68, 70, September 1985.

Descriptors: *Groundwater pollution, *Underground storage tanks, *Water pollution control, Water pollution, Legislation, Contamination, Volatile organic compounds, Drinking water.

Contamination of U.S. drinking water by chemical seepage into groundwater reservoirs may affect more than 117 million Americans. Groundwater contamination has been found in every state; more than 200 substances have been detected nationwide, and 29% of groundwater drinking water supplies to large cities contain volatile organic chemicals. Leaking underground storage tanks and pipe systems are chief contamination sources. Individual companies may face liability costs of millions of dollars. Prevention measures may include secondary containment, fiberglass storage tanks, and liner and/or double wall protection. The federal government has passed numerous statutes which can be applied to groundwater protection; however, states also are working to formulate, pass, implement, and enforce new laws and regulations to detect and clean up current groundwater contamination, and to prevent future occurrences. (Doria-PTT)
W86-05063

INFLUENCE OF AN ARTIFICIAL HYDRAULIC REGIME ON WATER QUALITY IN THE TIDAL RIVER LAGAN, NORTHERN IRELAND,
Department of Economic Development, Belfast (Northern Ireland). Industrial Science Div.
J. A. Wilson.
Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 5, p 423-436, October 1985. 10 fig, 4 ref.

Descriptors: *River Lagan, *Weirs, *Oxygen deficit, *Stratified flow, *Estuaries, Water quality, Hydraulic models, Surface water, Dissolved oxygen, Nitrates, Recreation, Flood control, Belfast, Northern Ireland.

This paper summarizes the reasons for oxygen-deficiency in the subsurface layer of the stratified flows created by the McConnell Weir. The stratified flow of the fresh water precludes the absorption of atmospheric oxygen - usually the predominant source of oxygen in surface waters. The stratified flow of the freshwater excludes supplies of dissolved oxygen and nitrates present in the freshwater inflows. The McConnell Weir acts as a barrier to the net non-tidal landward flow associated with the subsurface layers of naturally stratified estuaries. This permits pollutants to be retained for long periods in the reach. Removal of the McConnell Weir would result in a dramatic improvement in the quality of the waters in the Lagan, during the summer months. However, the consequences with respect to the appearance of the river, and existing recreational use, preclude such action. The remedial measure being adopted at present is restoration of the sluicing facilities. The feasibility of a proposed water level control structure is being studied. (Khumbatta-PTT)
W86-05080

CHEMISTRY, MICROBIOLOGY, AND MODELING OF CHLORINATION FOR ACTIVATED SLUDGE BULKING CONTROL,
California Univ., Berkeley. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W86-05083

RELATION BETWEEN DRINKING WATER NITRATE AND TOTAL NITRATE INTAKE,
Central Public Health Lab., London (England). Communicable Disease Surveillance Centre.
C. p. J. Caygill, B. Bartholomew, and M. J. Hill.
Aqua AQUAAA, No. 2, p 94-97, 1986. 3 fig, 2 tab, 17 ref.

Descriptors: *Drinking water, *Nitrates, *Human consumption, Gastric cancer, Water pollution effects, Water quality, Potable water, Urine, Chemical analysis.

Actual measured nitrate intakes are necessary for a proper evaluation of reports linking gastric cancer to nitrate exposure from drinking water and other sources. Recent improvements in methodology permit urinary nitrate to be assayed accurately. Nitrate balance studies using these methods indicated that 60-70% of an oral challenge dose of nitrate was excreted in the urine within 24 hr. Thus the 24 hr urinary nitrate output can be used to calculate the total nitrate intake. This method was used to measure daily nitrate intake of 476 adults drinking water of differing nitrate concentration and the percentage contribution by their water to this intake. It was found that water was the major contributor to nitrate intake only when its nitrate concentration exceeded 50 mg/l. (Lantz-PTT)
W86-05149

REPORT OF TASK COMMITTEE ON WATER QUALITY PROBLEMS RESULTING FROM INCREASING IRRIGATION EFFICIENCY.
American Society of Civil Engineers, New York. Irrigation and Drainage Div.
Journal of Irrigation and Drainage Engineering JIDEDH, Vol. 111, No. 3, p 191-198, September 1985. 15 ref.

Descriptors: *Water quality control, *Irrigation efficiency, *Information exchange, Salinity, Nitrogen, Irrigation practices, Leaching, Nitrates, Chemical reactions, Pesticides, Path of pollutants, Erosion control, Legal aspects, Irrigation effects.

This paper summarizes and integrates results presented in papers requested by the Task Committee on Water Quality Problems Resulting from Increasing Irrigation Efficiency, addressing the perceived effects of increasing irrigation efficiencies on water quality. These papers deal primarily with salinity and nitrogen relationships, and also analyze other ramifications of increasing irrigation efficiency. Increasing on-farm efficiency usually connotes providing water to meet crop needs with minimal deep percolation and surface runoff. Topics examined include leaching requirements, chemical reactions on the root zone, potential hazards and benefits of reduced leaching, nitrate leaching, basin-wide implications of increasing efficiencies, and effects on groundwater quality. Effects on erosion and the movement of pesticides are also considered. Physical changes to improve irrigation efficiency cannot be considered independently of the associated economic, social, legal, and institutional restraints. It is concluded that from a water quality viewpoint there is no reason to avoid increasing irrigation efficiency, but any such project should be analyzed thoroughly in advance to determine whether local circumstances warrant the improvements. (Lantz-PTT)
W86-05231

PLASTIC LINING ON RIVERTON UNIT, WYOMING,
For primary bibliographic entry see Field 8G.
W86-05240

OZONE ABSORPTION WITH REACTION IN BENZESULFONIC ACID AQUEOUS SOLUTIONS,
Naples Univ. (Italy). Ist. di Chimica Industriale e Impianti Chemici.
For primary bibliographic entry see Field 5F.
W86-05284

NEW APPROACH TO IN-SITU TREATMENT OF CONTAMINATED GROUNDWATERS,
Underground Resource Management, Inc., Austin, TX.
D. C. McMurtry, and R. O. Elton.
Environmental Progress, Vol. 4, No. 3, p 168-170, August 1985. 2 fig.

Descriptors: *Groundwater, *Water treatment, In Situ tests, *Water pollution control, Waste disposal, Wastewater.

The problem of groundwater contamination resulting from industrial waste storage, treatment and disposal practice, and from accidental spills, was considered with an in-situ approach. The conceptual design of the in situ treatment facility involved three phases: physico-chemical treatment, hydraulic design, and geotechnical design. Three case studies based on different designs were considered: 1) a petrochemical manufacturing plant, located along a small river, 2) an accident involving the spill of a tank truck loaded with acid waste, 3) and a hazardous waste landfill. It was concluded that in situ treatment of contaminated groundwaters using passive control and treatment techniques may prove to be an important method for remedial action. This technology would be limited to sites where the migration of contaminants is shallow and essentially horizontal. Further research is needed to develop methodology for the design of the barrier wall/treatment zone hydraulic controls, and for the geotechnical considerations during construction. At this time, numerical modeling was found to be the most appropriate approach in most real world applications for the hydraulic control design. (Masters-PTT)
W86-05286

MERSEY ESTUARY POLLUTION ALLEVIATION SCHEME,
North West Water Authority, Warrington (England).
For primary bibliographic entry see Field 5D.
W86-05304

MULTI-LAYER SAMPLER FOR THE STUDY OF DETAILED HYDROCHEMICAL PROFILES IN GROUNDWATER,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
D. Ronen, M. Magaritz, and I. Levy.
Water Research, Vol. 20, No. 3 p 311-315, March 1986. 5 fig, 11 ref.

Descriptors: *Groundwater pollution, *Water quality, *Water sampling, Chemical properties, Wells, Aquifers, Deep wells, Test wells, Monitoring, Water analysis, Saline water, Israel.

A modular multi-layer sampler was developed and utilized for sampling undisturbed groundwater chemical profiles. Sampling at 3 cm depth intervals is based on the dialysis-cell method and has no depth limitations. The sampler may be used for water quality monitoring and research, both in existing or specially drilled screened wells. The sampler was tested in a research well drilled in the deep, sandy and phreatic Coastal Plain aquifer of Israel. Excellent sampling reproducibility was obtained from different dialysis cells located in the same solutions for different equilibration times. The sampler was also capable of measuring both large and small salinity gradients at 3 cm intervals. The sampler is inexpensive and easy to operate and demonstrates good potential for monitoring bodies of contaminated groundwater. A floating version of the sampler is presently being developed to move inside the well according to variations in the water table. (Geiger-PTT)
W86-05336

ESTUARINE, COASTAL AND OCEAN POLLUTION: EEC POLICY AND RESEARCH,
Commission of the European Communities, Brussels (Belgium). Directorate General for Research, Science and Education.
P. Bourdeau, and H. Barth.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 1-14, 1986. 3 tab.

Descriptors: *Estuaries, *Water pollution control, *Research priorities, *Policy making, Coastal zone management, Coastal waters, Oil pollution, Water pollution sources, Path of pollutants.

This paper presents an overview of the policy and research of the European Community concerning estuarine, coastal and marine pollution. The structure and implementation of the European Community marine environmental policy, intended to combat the various types of pollution of the sea, and to protect the European waterways and the marine environment are described. Particular reference is made to actions dealing with oil pollution and other harmful chemical substances released into the sea. The environmental research program, aimed at providing scientific support to the environmental policy of the European Community, addresses short-, mid- and long-term problems, dealing mostly with pollution: its sources, detection, fate, pathways, environmental and genetic effects. Abatement and prevention of pollution by oil, wastes, fertilizers, heavy metals and other environmental chemicals are also discussed. It is also increasingly concerned with improving the understanding of the functioning of estuarine, coastal and marine ecosystems. The future orientations of the Community's marine environmental policy and research will stress the preventive aspects of environmental protection. (Lantz-PTT)
W86-05352

STRATEGY FOR DESIGN OF MARINE POLLUTION MONITORING STUDIES,
SEAMOcean, Inc., Wheaton, MD.
D. A. Segar, and E. Stamman.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 15-26, 1986. 13 ref.

Descriptors: *Marine pollution, *Monitoring, *Water pollution, Research design, Water pollution control, Management planning, Statistical methods.

Most historical marine pollution monitoring has proven useless in a management context. A strategy for the development of effective marine pollution monitoring programs is outlined. This strategy is based on the following steps: (1) systematic evaluation of the management information needs, (2) identification of the hypothetical impacts associated with those management concerns, and (3) investigation of the feasibility of monitoring those effects such that the existence, or absence, of a specified level of effects can be established in a statistically-valid manner. There are two fundamentally different types of monitoring programs: site-specific and regional, which differ markedly in scope and approach when designed through the application of this strategy. The strategy requires development of null hypotheses which address management concerns and are amenable to scientific testing. In order for the program to be successful, the null hypotheses selected for inclusion in a marine pollution monitoring program must address levels of effect which are predefined to be environmentally significant. The definition of environmentally significant effect levels is a difficult process which must be primarily the responsibility of the managerial community. (Lantz-PTT)
W86-05353

ANALYTICAL QUALITY CONTROL (AQC) FOR MONITORING TRACE METALS IN THE COASTAL AND ESTUARINE ENVIRONMENT,
Water Research Centre, Marlow (England).
M. J. Gardner, D. T. E. Hunt, and G. Topping.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 35-41, 1986. 1 fig, 1 tab, 18 ref.

Descriptors: *Water quality control, *Water analysis, *Trace metals, *Estuaries, Water pollution control, Monitoring, Cadmium, Mercury, Coastal waters, Saline water.

Recognizing the difficulty of quality control in laboratory monitoring programs, the (U.K.) Marine Pollution Monitoring Management Group (MPMMG) and the Water Research centre (WRc) have organized a program of Analytical Quality Control (AQC). This has the objective of ensuring that analytical results for filterable cadmium and mercury in saline waters, obtained by water indus-

try and other relevant laboratories, are of adequate accuracy and comparability for their intended uses. WRc is to coordinate a series of tests, some involving distributions of standards and samples, which the participating laboratories undertake; this series of tests, the background to the approach and some of the results obtained to date, are described here. (Lantz-PTT)
W86-05355

EFFECTIVENESS OF SAMPLING STRATEGIES FOR INTERTIDAL MONITORING,
Victoria Univ. of Manchester (England). Dept. of Zoology.
For primary bibliographic entry see Field 7B.
W86-05358

SAFE USE OF THE ASSIMILATIVE CAPACITY OF THE MARINE ENVIRONMENT FOR WASTE DISPOSAL - IS IT FEASIBLE,
Ministry of Agriculture, Fisheries and Food, Burnham on Crouch (England). Fisheries Lab.
J. E. Portmann, and R. Lloyd.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 233-244, 1986. 3 tab, 23 ref.

Descriptors: *Water quality control, *Assimilative capacity, *Marine environment, *Waste disposal, Path of pollutants, Water pollution control, Water pollution sources.

For centuries the sea has absorbed a variety of inputs from rivers, streams, salt marshes and the atmosphere. It is generally accepted that additional limited inputs by man are unlikely to have a significant effect on the marine environment. Various control systems have been constructed to provide a framework within which the regulation of anthropogenic inputs can be achieved. These are briefly reviewed. With care, and in the light of past experience in both freshwater and marine environments, reasonable assumptions or estimations can be applied where uncertainties exist, and safe limits can be set for discharges. Case histories are used to illustrate the contention that it is possible to assess the assimilative capacity of a marine area to receive wastes. There is a major distinction to be drawn between contamination and pollution of the marine environment. Moreover, acknowledgement of the assimilative capacity concept in the marine environment does not automatically provide dischargers with the right to utilize that capacity either in part or to the upper limit. What it does is indicate the upper limit which must not be exceeded if pollution is to be avoided, and provide an indication to the control authority of the safety margin involved in the discharge limits they set accordingly. (Lantz-PTT)
W86-05376

DEFINITION OF EFFLUENT DISCHARGE CONSENT CONDITIONS IN COMPLEX ESTUARINE ENVIRONMENTS,
Welsh Water Authority, Bridgend. Tidal Waters Unit.
R. A. Milne, P. C. Nicholas, C. Pattinson, and W. Halcrow.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 267-276, 1986. 2 fig, 12 ref.

Descriptors: *Effluent limitations, *Estuarine environment, *Water quality standards, Assimilative capacity, Coastal zone management, Loughor Estuary, Dee Estuary, Wales, Mathematical modeling, Water pollution effects, Legal aspects.

The Welsh Water Authority puts considerable emphasis upon the scientific determination of discharge consents through which it controls coastal pollution. It also pursues a policy which encourages the effective use of estuarine and coastal capacity to assimilate effluents. Conflict between environmental protection and costs-effective effluent disposal is minimized by concentrating upon the relationships between environmental quality objective (E.Q.O.), environmental quality standard (E.Q.S.) and discharge consent. Welsh Water has devoted considerable resources to the understanding and prediction of these relationships in estuaries, developing a protocol for consent setting. The protocol is described and illustrated with examples from recent work on the Loughor and Dee estuaries in Wales. Desk studies, specialized investigations and mathematical modelling techniques are integrated to identify critical processes in the dispersal, degradation and biological impact of pollutants. These are modelled to predict effluent behavior for various discharge regimes, allowing a flexible approach to the selection of a consent. (Lantz-PTT)
W86-05379

DERIVATION AND APPLICATION OF ENVIRONMENTAL QUALITY OBJECTIVES AND STANDARDS TO DISCHARGES TO THE HUMBER ESTUARY (U.K.),
Anglian Water Authority, Huntingdon (England).
D. R. Sayers.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 277-285, 1986. 1 tab, 7 ref, append.

Descriptors: *Environmental quality, *Environmental policy, *Humber Estuary, *England, Discharge capacity, Estuaries, Mixing, Titanium dioxide, Water quality control, Water pollution control, Cost analysis, Outfall.

In November 1983 a set of environmental quality objectives (EQO) and standards (EQS) was published for the Humber estuary. This paper discusses some of the reasons for choosing these particular objectives and standards. It explains that a mixing zone (within which the objectives and standards may not be met) is permitted around individual effluent outfalls, and examines various options for setting the size of that mixing zone. Mixing zone size should perhaps be defined principally by length. If this length was calculated as an agreed percentage of tidal excursion or current speed at the point of discharge then zone size would be related directly to tidal energy. Where a diffuser is fitted, however, mixing zone size may need to be calculated not solely as a length but in a way that reflects the increased importance of the width of the plume and the size of the pool of effluent that forms a slack water. The mixing zone is the area within which environmental damage will be tolerated. But the use of chemical EQSs to define environmental damage fails to relate zone size directly to the effect an effluent has on the life of the estuary. The use of a biological criterion may overcome this, but it is often only possible to relate such extreme biological effects to an individual outfall. The derivation of reliable but less extreme biological EQSs, is an area where further research may be worthwhile. Ultimately, the decision of how large a mixing zone should be, has to be taken subjectively, and is a cost benefit judgement. In the present financial climate, reducing mixing zone sizes to acceptable proportions may take a number of years. (Lantz-PTT)
W86-05380

LICENSING A MAJOR INDUSTRIAL DISCHARGE TO COASTAL WATERS: THE PRACTICAL APPLICATION OF THE EQO/EQS APPROACH,
Clyde River Purification Board, East Kilbride (Scotland).
D. W. Mackay, A. J. N. Haig, and R. Allcock.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 287-295, 1986. 1 fig, 4 tab, 17 ref.

Descriptors: *Licensing, *Industrial wastes, *Coastal waters, *Environmental quality, Scotland, Estuaries, Receiving waters, Clyde River, Irvine Bay, Legal aspects, Copper.

The Environmental Quality Objective/Environmental Quality Standard approach to controlling pollution in Britain's well mixed and highly dispersive coastal waters, has been adopted by the Government. The task of the regulatory authority in relating discharge conditions to the capacity of the receiving waters, is theoretically a logical sequence of scientific calculations. In practice, a whole range of influences are brought to bear on the decision making process. This paper describes how the Clyde River Purification Board and a major chemical manufacturing company (ICI) arrived at consent conditions for the discharge of an effluent containing copper, into the Irvine Bay, in the Firth of Clyde, an area of major importance as a fishery. The technical arguments advanced during negotiations are detailed, and the areas of major disagreement such as the definition of a mixing zone are discussed. Taken into account are the uses to which the Bay is put, and the effect of other discharges on background levels. Measures taken to ensure demonstrable compliance with the agreed consent conditions are described, as are biological monitoring methods under development which assess the long term acceptability of the discharge. (Lantz-PTT)
W86-05381

REMOVAL OF PARAQUAT, DIQUAT, AND AMITROLE FROM AQUEOUS SOLUTION BY CHEMICALLY MODIFIED PEAT,
Colorado School of Mines, Golden. Dept. of Chemistry and Geochemistry.
P. Mac Carthy, and K. E. Djebbar.
Journal of Environmental Quality JEVQAA, Vol. 15, No. 2, p 103-107, April-June 1986. 1 fig, 3 tab, 24 ref.

Descriptors: *Paraquat, *Diquat, *Amitrole, *Peat, Wastewater treatment, Water pollution treatment, Pesticides, Leaching, Adsorption, Cation exchange.

The presence of organic pesticides in aquatic systems has been reported for more than 40 yr. Various methods, such as sorption by clays, activated C, or synthetic resins, have been used to remove these pesticides from water. Certain pesticides, such as the cationic species paraquat ($C_{12}H_{14}N_2Cl_2$; 1,1'-dimethyl-4,4'-bipyridinium dichloride), diquat ($C_{12}H_{12}N_2Br_2$; 6,7-dihydrodipyrido(1,2-a:2', 1'-c)pyrazinediium dibromide), and the basic species amitrole ($C_2H_4N_4$; 3-amino-s-triazole), are sorbed by peat. However, the use of raw peat as a sorption medium for the removal of pesticides is hampered by the relative impermeability of peat, the leaching of organic matter from peat into the effluent, and by the disaggregation of peat at pH values greater than about 6.0. Treatment of peat with concentrated sulfuric acid at elevated temperatures yields a granular product that has an enhanced cation exchange capacity, is resistant to leaching, and is permeable to water flow. The objective of this research was to evaluate the use of this chemically-modified peat for removing paraquat, diquat, and amitrole from aqueous solution under a variety of experimental conditions. Using isotherm and column experiments, it was shown that the treated peat is very effective in removing these pesticides from aqueous solution, with a capacity of about 1 mol (+)/kg for these three pesticides. The effects of pH, ionic strength, and flow rate of the efficiency of pesticide removal were found to be relatively small. Peats from two different localities behaved similarly in these experiments. (Lantz-PTT)
W86-05383

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

DISJUNCTIVE KRIGING: 1. OVERVIEW OF ESTIMATION AND CONDITIONAL PROBABILITY,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
S. R. Yates, and A. W. Warrick.
Water Resources Research WRERAO, Vol. 22, No. 5, p 615-621, May 1986. 2 fig, 1 tab, 19 ref.

Descriptors: *Disjunctive kriging, *Probabilistic process, *Estimating, *Statistical analysis, Mathematical studies, Analysis of variance, Management planning, Kriging.

The disjunctive kriging method described in this paper produces a nonlinear unbiased estimator with the characteristics minimum variance of errors. Disjunctive kriging is as good, or better than linear estimators in the sense of reduced krig-

ing variance and exactness of estimation. It does not suffer from the difficulties associated with computing the conditional expectation and can be thought of as its estimator. Disjunctive kriging also provides an estimate of the conditional probability that a random variable located at a point, or averaged over a block in two-dimensional space, is above some specified cutoff or tolerance level. This can be written in terms of the probability distribution or the density function. The method has important implications in aiding management decisions by providing a quantitative input (which is not readily obtained from the linear kriging estimators), based on the available data, which is the best nonlinear unbiased estimator short of the conditional expectation. A major disadvantage in using disjunctive kriging is the increased computational time. This, however, is mitigated by increased information about the estimate. (see also W86-05208)(Lantz-PTT)
W86-05207

DISJUNCTIVE KRIGING: 2. EXAMPLES,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
S. R. Yates, and A. W. Warrick.
Water Resources Research WRERAO, Vol. 22, No. 5, p 623-630, May 1986. 13 fig, 4 tab, 15 ref.

Descriptors: *Disjunctive kriging, *Probabilistic process, *Estimating, *Statistical analysis, Mathematical studies, Analysis of variance, Management planning, Kriging.

The disjunctive kriging (DK) method is illustrated by two examples. The first example is for the electrical conductivity (EC) which is approximately lognormally distributed. In the second example the natural logarithm of the EC is used to produce an approximately normally distributed data set. The data set was chosen because the Hermite coefficients for a normal and lognormal distribution could be determined analytically, as well as to facilitate a comparison between ordinary and disjunctive kriging. The capability of DK to be a nonlinear estimator and an estimator of the conditional probability is explored. The results indicate that DK is a better estimator than linear estimators (i.e., ordinary kriging) in the sense of reduced variance of errors and average kriging variance, even when the data are approximately normally or lognormally distributed. Also, by using DK, one can obtain an estimate of the conditional probability. (see also W86-05207) (Lantz-PTT)
W86-05208

APPROACH FOR FREQUENCY ANALYSIS OF MULTIYEAR DROUGHT DURATIONS,
Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W86-05212

IMPLICATIONS OF HEAD LOSS PATH CHOICE IN THE OPTIMIZATION OF WATER DISTRIBUTION NETWORKS,
Manitoba Univ., Winnipeg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W86-05229

6B. Evaluation Process

ECONOMIC LIMITS OF SMALL AND LOW-HEAD HYDRO,
Monenco Consultants Ltd., Montreal (Quebec).
J. L. Gordon, and R. C. R. Noel.
Water Power and Dam Construction, Vol. 38, No. 2, p 23-26, April 1986. 2 fig, 4 tab, 11 ref.

Descriptors: *Hydroelectric power, *Small hydro, *Low-head hydro, *Economic feasibility, Cost analysis, Economic life, Damsite.

A simple engineering methodology is presented for estimating the likely minimum cost of a small hydropower development on a new site, based on an analysis of cost data from 141 sites, along with a methodology for estimating whether these sites are likely to be sufficiently attractive to warrant detailed investigation. The method is not intended for use at sites where some of the structures have been built, such as dams. A basic premise of the method is that the project must display benefits, that over its economic life, exceed its costs. First, a simple methodology is derived for estimating the minimum cost of constructing a hydro plant at a specific site. Next, an estimate of the maximum benefits that can be expected from the site is developed. It is suggested that, under these conditions, if the costs exceed the benefits, the site is clearly uneconomic and should be rejected from further consideration. A site with apparent benefits exceeding its costs should not be considered economic, but as a site with potential deserving detailed investigation. (Rochester-PTT)
W86-04724

DEVELOPING SMALL HYDRO IN INDIA,
Teknow Consultants and Engineers Pvt. Ltd., New Delhi (India).
For primary bibliographic entry see Field 8C.
W86-04728

PROJECT APPRAISAL IN WATER RESOURCE DEVELOPMENT IN BAVARIA,
Bayerisches Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.).
R. F. Schmidtke.
Institution of Water Engineers and Scientists Journal, Vol. 39, No. 5, p 452-461, October 1985. 6 fig, 3 ref.

Descriptors: *Water resources development, *Bavaria, *Evaluation, Hydroelectric power, Project planning, Public participitation, Legal aspects.

The planner of water resources projects must take, as a starting point, the working hypothesis that he cannot have an overview of all the problems that are likely to occur. Planning must be done as a consultative, iterative, and interactive process. In this connection, the public plays an increasingly influential role. Normally, three reasons are given for public participation: (1) It provides more information for planners and other govenment authorities, and thus improves the quality of planning and decision making; (2) It can also provide as sense of (public) satisfaction by creating a feeling of consensus and it creates a better atmosphere for plan acceptance. Large-scale or complex projects in particular, can induce distrust in lay persons because they do not understand all the issues: this should be avoided at all costs. Irrational fears must be brought into the open, in order to distinguish them from the legitimate problems. In addition, the social evolution in recent years has increased the desire for more participation in all areas; and (3) It may contribute to safeguarding the public's legal rights. It is not a question of a lack of research activity that restricts the implementation of new techniques. It is a problem of training the planners in the use of such techniques. (Lantz-PTT)
W86-05306

ROLES ALONG THE RIVERS,
For primary bibliographic entry see Field 6E.
W86-05327

SIGNIFICANCE OF ENVIRONMENTAL IMPACTS: AN EXPLORARION OF THE CONCEPT,
Dalhousie Univ., Halifax (Nova Scotia). Inst. for Resource and Environmental Studies.
For primary bibliographic entry see Field 6G.
W86-05410

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

SUMMER DISCOUNT METHODS IN SANITARY SEWER RATE STRUCTURES,
Lexington Dept. of Public Works, KY.
R. D. Wiseman.
Public Works, Vol. 117, No. 5, p 63-64, 96, 98, May 1986.

Descriptors: *Sewer systems, *Rate structures, *User charges, Summer discount methods, Lexington, Water metering, Water use, Kentucky.

Sewer authorities have devised many ways to handle discounting residential seasonal water use. These include: flat 10 percent spring summer discount; use of winter meter read year round; swimming pool only deductions; fall winter average for use in spring summer; use of 90 percent of water meter read year round; a flat rate based on meter size year round; use of the previous year low quarter meter read for the entire current year; two rate structures including a winter rate and a summer rate; hybrid systems whereby high months and low months are averaged; special application to an appeals board; maximum residential bill based on a set maximum number of gallons; and special meter read. Those communities that are reviewing their user fee rate structures are advised to take several steps if the demand for a sprinkling exemption is present. These include a seasonal and monthly analysis of water flows and an isolation of those factors that may give rise to monthly or seasonal variations. In Lexington, KY billing is on actual water consumption during fall and winter for residential customers with the spring and summer quarters being a winter average calculated usage. For commercial customers, billing is on actual water usage year round unless a customer installs a sewer or water meter and a special application is required for this. For apartment complexes, billing is on 97 percent of actual usage year round. (Peters-PTT)
W86-04684

TIGHT MONEY HAMPERS CLEVELAND SEWER JOBS,
J. Kosowatz.
Engineering News Record, Vol. 216, No. 20, p 56-57, May 15, 1986.

Descriptors: *Ohio, *Financing, *Interceptor sewers, *Environmental Protection Agency, *Tunnels, *Aerial crossing, Valleys, Pipelines, Sewage rate, Construction, Court order.

Financing difficulties and funding challenges are associated with the Northeastern Ohio Regional Sewer District. Although lacking funds, the utility is being forced by court order to continue constructing the 329 million dollar program to build two large sewer interceptors: the 18-mile Southwest interceptor and the 28-mile Heights/Hilltop interceptor, which are intended to relieve aging, overburdened collectors that constantly back up and overflow into waterways in Cleveland and 43 surrounding communities. A cap on funding by the Environmental Protection Agency may force increases in sewer charges in the Cleveland area to pay for this and other projects. Construction has been proceeding on schedule, including tunneling through both hard and soft rock and traversing the Cuyahoga River valley with a 1,150-ft aerial crossing to carry nineteen 9.5-ft-diameter steel pipe segments. (Rochester-PTT)
W86-04754

DRINKING WATER COST EQUATIONS,
Municipal Environmental Research Lab., Cincinnati, OH. Drinking Water Research Div.
For primary bibliographic entry see Field 5F.
W86-04942

WATER DEMAND ESTIMATION UNDER BLOCK RATE PRICING: A SIMULTANEOUS EQUATION APPROACH,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6D.
W86-05243

ECONOMIC APPRAISAL OF ACTIVE AND PASSIVE METHODS OF LEAKAGE CONTROL,
Mid Kent Water Co., Canterbury (England).
M. T. Setford.

Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 6, p 494-500, December 1985. 3 fig, 4 tabs.

Descriptors: *Leakage, *Water main, *Water distribution, *Cost analysis, Economic aspects, Water treatment, Comparison studies.

A series of tests was set up in each of the Mid Kent Water Company's three divisions to compare active and passive methods of leakage control and to determine the economic effectiveness of testing waste districts. Each division adopted a different frequency for monitoring leakage to include monthly, bi-monthly, and quarterly testing, with one of the test areas within each division being subjected to an active leakage control program and the other area monitored using passive leakage control only. The trends of leakage within the active and passive test areas varied considerably between the three divisions. Within Ashford division the trends of leakage were more pronounced than in the other test areas, especially in the passive areas. This was attributed to the old leakage prone mains in this division and the nature of the ground which alluvium and more likely to show bursts readily. In the Canterbury passive area, the ground is brickearth which tends to reveal leaks fairly readily, as do the Hythe Beds in the Maidstone passive test area. It was concluded that the economic viability of adopting any leakage control policy will depend upon the comparative pumping and treatment costs between different areas of supply, the potential financial benefit obtained by deferring capital expenditure on the expansion of existing distribution schemes and/or major source development, and the ability to achieve predetermined target levels of leakage in order to be able to defer capital expenditure. (Geiger-PTT)
W86-05317

OUTPUT AND INVESTMENT FRONTIERS OF UNITED STATES IRRIGATED AGRICULTURE,
Idaho Univ., Moscow. Dept. of Agricultural Economics.
R. B. Long.
Water Resources Bulletin, Vol. 21, No. 4, p 553-564, August 1985. 16 fig, 3 tab, 2 ref.

Descriptors: *Water allocation, *Irrigation water, *Cost analysis, *Land use, *Economic aspects, Investment, Agriculture, Irrigation, Evaluations, Benefits.

Economic models sometimes indicate that irrigation water is misallocated in agriculture, especially when it appears that the marginal value product is higher in other uses (such as for hydropower). Historically, trends tend to contradict this reasoning, especially since irrigation has grown from 20 million acres in 1940 to over 50 million acres in 1980. Sixteen relationships were examined to show the economic benefits of irrigated agriculture. The relationships covered such factors as dryland vs. irrigated agriculture, cash receipts and land use, real estate investment and land use, and machinery and livestock investments. The sixteen relationships examined tended to confirm that irrigated land was related to new output and investment in seven of eight relationships, while dryland use was positively related to new output or investment in only two of eight relationships. As agriculture becomes more and more intensive (in terms of inputs), irrigation is part of that long term trend. Major economic variables, such as output and investments in agriculture, appear to be more highly correlated with irrigated land than with dryland agriculture. From these findings, it is concluded that water is not misallocated when used for crop production. (Geiger-PTT)
W86-05326

6D. Water Demand

WATER IS THE KEY TO MUNICIPAL GROWTH,
Scepter Mfg. Co. Ltd., Scarsborough (Ontario).
T. E. Walsh.
Public Works, Vol. 117, No. 3, p 82-83, March 1986.

Descriptors: *Water shortage, *Polyvinyl chloride pipe, *Plastic pipes, *Economic growth, *Pueblo, Colorado.

The response of the Pueblo (Colorado) Board of Water Works to an impending shortage of water that might stifle industrial growth is described. Two major corporations had expressed interest in developing major facilities in Pueblo, but both were concerned about possible water shortages affecting industrial processes and fire protection. Polyvinyl chloride (PVC) pipe (16 in diameter) was chosen to provide a supplementary water line parallel to an existing one. The installation was ahead of schedule due to good weather, timely pipe deliveries, high productivity, and full-time inspection. The pipe was successfully tested at 165 lb/sq in; bacteria tests showed no contamination problems. (Rochester-PTT)
W86-04734

METHOD FOR USING COMPUTERIZED CUSTOMER INFORMATION IN WATER DISTRIBUTION NETWORK MODELS,
Newcastle and Gateshead Water Co., Newcastle-upon-Tyne (England).
For primary bibliographic entry see Field 7B.
W86-04749

FLOODS IN BRITAIN'S BASEMENT; INDUSTRY'S DEMAND FOR WATER IS PLUMMETING. AS A RESULT, RISING GROUND WATER THREATENS TUNNELS AND DEEP FOUNDATIONS IN MANY CITIES,
For primary bibliographic entry see Field 4C.
W86-04969

WATER RESOURCE AND SUPPLY DEVELOPMENT IN BRUNEI DARUSSALAM,
Watson Hawksley Asia, Brunei Darussalam.
For primary bibliographic entry see Field 5F.
W86-05078

PRIMARY INFLUENCE FACTORS ON DOMESTIC WATER DEMAND IN EUROPE,
Gelsenwasser A.G., Gelsenkirchen (Germany, F.R.).
H. Gundermann.
Aqua AQUAAA, No. 2, p 81-85, 1986. 7 fig.

Descriptors: *Water demand, *Domestic water, *Water demand, *Europe, *Available water, Water users, Human population, Rainfall, Population density, Water management, Water supply, Water use efficiency.

Many factors influence the quantity and structure of domestic water demand. However, in spite of national and regional differences concerning domestic water supply, there are generally valid influence factors in Europe. The public and practicians call for evident and definite reasons concerning the trend of water demand. It is not possible to comment on more than 100 influence factors which, in any case, will differ from country to country and from undertaking to undertaking. It is, however, necessary in daily work, to choose those statistical primary factors which are in direct relationship with the water demand. From past experiences and special scientific research, the following influence factors may be regarded as general determinants: 1) Number of inhabitants, population trend; 2) Number and equipment at properties; 3) Weather and rainfall; 4) Settlement structure (supply density, towns and countryside); and, 5) Consumer habits (general principles of conduct, water consciouness, water saving attitudes). The dominating factor is undoubtedly the number of inhabitants. Other factors, e.g. size of income, education of the head of household, water quality or even overall economy factors or living standards, can be disregarded as they are usually expressed in separate index figures. (Lantz-PTT)
W86-05147

IRRIGATION WATER REQUIREMENTS FOR SENEGAL RIVER BASIN,
Army Engineer District, New York.
G. L. Hargreaves, G. H. Hargreaves, and J. P. Riley.
Journal of Irrigation and Drainage Engineering JIDEDH, Vol. 111, No. 3, p 265-275, September 1985. 3 tab, 12 ref, append.

Descriptors: *Irrigation practices, *Water requirements, *Senegal River, River basins, Africa, Economic impact, Agricultural engineering, Crop production, Water demand, Rainfall, Farm management, Mauritania, Mali.

The Senegal River is a major natural resource in West Africa where the principal economic resources are agricultural. A proposed irrigation project will provide a significant increase in crop production and will exert a large influence on the economics of Senegal, Mauritania, and Mali. The magnitude of benefits from the project will depend upon the allocation, scheduling and managing of that portion of the water to be used for irrigating agricultural crops. A procedure is recommended for estimating crop water requirements that only requires the measurement of maximum and minimum temperatures. This procedure although calibrated for the Senegal River Basin using climatic data from four representative locations appears to be generally applicable for other areas without calibration. The importance of rainfall in supplying part of crop water requirements is described. Mean, actual dependable and effective precipitation values are compared for one location. Block farming or the planting of a single crop to manageable areas should be made mandatory. (Lantz-PTT)
W86-05238

DAILY WATER USE IN NINE CITIES,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 3D.
W86-05241

APPLICATION OF FUNCTIONAL ANALYSIS TO OPTIMIZATION OF A VARIABLE HEAD MULTIRESERVOIR POWER SYSTEM FOR LONG-TERM REGULATION,
Ain Shams Univ., Cairo (Egypt). Faculty of Engineering.
For primary bibliographic entry see Field 8C.
W86-05242

WATER DEMAND ESTIMATION UNDER BLOCK RATE PRICING: A SIMULTANEOUS EQUATION APPROACH,
Illinois Univ. at Urbana-Champaign. Dept. of Agricultural Economics.
D. L. Chicoine, S. C. Deller, and G. Ramamurthy.
Water Resources Research WRERAO, Vol. 22, No. 6, p 859-863, June 1986. 1 tab, 30 ref.

Descriptors: *Water demand, *Estimating, *Pricing, *Simultaneous equations, Mathematical analysis, Statistical analysis, Potable water, Estimating equations, Rural areas.

A model of demand for potable water is developed and estimated simultaneously with observations on rural water district customers. The estimation technique incorporates the error structure in an attempt to provide more efficient estimates and eliminate potential ordinary least squares bias in single equation models of demand for goods sold through block rate pricing systems because of possible price endogeneity. The model also tests alternative specifications for price variables. The simultaneous equation model estimates from three-stage-least squares were slightly more efficient than those available using two-stage-least square estimates. The findings are not generally supportive of the Taylor-Nordin specification of consumer demand for block rate priced potable water. The similarity between three-stage-least squares and single equation ordinary least squares estimates provides some validation for the use of simpler single equation demand models of potable water, when water is sold under block rate pricing schedules. (Lantz-PTT)
W86-05243

BETTER ACCOUNTING FOR UNACCOUNTED FOR WATER,
Wessex Water Authority, Poole (England).
For primary bibliographic entry see Field 3D.
W86-05315

6E. Water Law and Institutions

DRINKING WATER BILL SAILS THROUGH CONGRESS,
For primary bibliographic entry see Field 5G.
W86-04766

OPPORTUNITIES FOR IMPROVING THE COST-EFFECTIVENESS OF ACID RAIN CONTROL STRATEGIES,
Argonne National Lab., IL. Energy and Environmental Systems Div.
For primary bibliographic entry see Field 5G.
W86-04946

PUBLIC RELATIONS PLOYS HAVE TRANSFORMED REGULATORY ISSUE INTO CONSUMER CONCERN,
R. L. Stanfield.
National Journal, Vol. 18, No. 4, p 213-215, January 25, 1986.

Descriptors: *Legislation, *Hydroelectric Plants, *Public Relations, Permits, Legal Aspects, Edison Electric Institute.

Privately owned electric utilities are seeking renewal of expiring federal hydroelectric licenses to permit use of the nation's falling waters to generate electricity. Frustrated by years of congressional disinterest, lobbyists hired public relations consultants. To date, the PR firm's direct mail tactics have produced positive results–citizens write congressmen, newspapers print editorials, and it seems likely that Congress will pass the Electric Consumers Protection Act (ECPA; S 426, HR 44) to practically guarantee reissuance of licenses to privately owned concerns, thereby striking down preexisting prejudice towards those publicly owned. Supporters of municipal control claim that the Committee for ECPA is only a front for Edison Electric Institute and other companies and organizations pushing the legislation. The power struggle continues; each side accuses the other of spending millions of dollars for promotion of its goals, with the cost therefor borne by consumers. (Doria-PTT)
W86-05058

ROLES ALONG THE RIVERS,
J. A. Kusler.
Environment, Vol. 27, No. 7, p 18-20, 37-44, September 1985. 29 ref.

Descriptors: *Management planning, *River basins, *Water law, *Federal jurisdiction, *Local governments, Riparian Land, Riparian waters, Rivers, River basin development, Resources management, Project planning.

An overview of federal, state, and local policies for river management in the United States is given. Since 1968, three major federal programs have been adopted that provide partial control over river corridor lands (channel and adjacent floodplains, wetlands, riparian habitats, and other related areas). The National Flood Insurance Program made federally subsidized flood insurance available for existing structures in communities that establish minimum regulatory standards for elevation or for floodproofing of new construction. Section 404 of the Water Pollution Control Amendments of 1972 and the Clean Water Act of 1977 require that any individual must get a permit from the U.S. Army Corps of Engineers in order to discharge any fill or dredge materials into the nation's waters. The Wild and Scenic River Program protects designated waterways from federal water projects. State river management programs include floodplain management programs, shoreland zoning programs, wetland regulatory programs, scenic, wild, or recreational river programs, special management areas programs, and regulation of dams, in-stream uses, and water appropriations. Local governments differ in their river-corridor management approaches according to size, location, and funding. Some examples of rural and urban programs are illustrated. To strengthen state programs for river-corridor management, the administration and congress should re-examine their role in enhancing state roles, improve training and subsidy for management projects, and adopt a state and local river-corridor management act. (Geiger-PTT)
W86-05327

ECOLOGICALLY DERIVED GUIDELINES FOR MANAGING TWO NEW ZEALAND LAKES,
Otago Univ., Dunedin (New Zealand). Dept. of Botany.
A. F. Mark, and P. N. Johnson.
Environmental Management, Vol. 9, No. 4, p 355-364, July 1985. 7 fig, 1 tab, 16 ref.

Descriptors: *Standards, *Hydroelectric plants, *Ecological effects, *Lake shores, Legislation, Vegetation, New Zealand, Lake Manapouri, Lake Te Anau, Glacial lakes, Operating policies.

The details and ecological basis of the legislation governing the use of Lakes Manapouri and Te Anau, in Fiordland National Park, New Zealand, by and overseas aluminum smelting consortium for electricity generation, are summarized. The lake levels were not raised as orginally proposed. Rather, government sought guidelines to optimize hydroelectric potential while maintaining ecological stability of the glaciated lakeshores. Guidelines were derived by relating the vegetation zonation to the natural lake-level fluctuations recorded daily for 37 years. A high operating range in the upper third of the lakes' natural ranges, based on flood tolerances of the woody shoreline species, restricts both duration and frequency. A low operating range (ca. lower third) safeguards stability of shoreline sediments by limiting drawn-down rates, duration and frequency. The main operating range (ca. middle third) has few limitations. These guidelines, which allow utilization of 93% of the water resource, have now been verified by instances of flooding and draw-down rates that exceeded the natural rates recorded earlier. The guidelines were officially accepted by the government in 1977 as a basis for managing the valuable multiple resources of these two lakes and their environs, and they were formalized in legislation in 1981. (Peters-PTT)
W86-05399

6F. Nonstructural Alternatives

FLOOD FREQUENCY ANALYSIS WITH HISTORICAL AND PALEOFLOOD INFORMATION,
Cornell Univ., Ithaca, NY. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 2E.
W86-05225

6G. Ecologic Impact Of Water Development

PAPAGO WATER SUPPLY PROJECT: CLASS III ARCHAEOLOGICAL SURVEY FOR SCHUK TOAK AND SAN XAVIER DISTRICTS; RESEARCH DESIGN,
Franzoy-Corey Engineering Co., Tempe, AZ.
A. Dart, W. H. Doelle, and T. R. McGuire.
Institute for American Research, Technical Report No. 85-6, 1985. 44 p, 1 fig, 1 tab, 49 ref, 3 append.

Descriptors: *Archaeology, *Arizona, *Water resources development, *Resources development, Water allocation, Resources allocation, Available water, Water use, Water delivery, Water demand, Water conveyance.

Part of the planning process for the Papago Water Supply Project, Arizona, a Class III cultural resource survey included: location and environmental conditions of the project area, problem domains, site definition and classification, archaeological field methods, ethnohistoric research methods, and project structure. An Archaeological Resources Protection Ordinance waspresented. The geomorphology of the Schuk Toak area is described and presented in map form. (Halterman - PTT)
W86-04817

EFFECTS OF WATER DEVELOPMENT ON THE HYDROLOGY AND MORPHOLOGY OF PLATTE RIVER CHANNELS, SOUTH-CENTRAL NEBRASKA,
Geological Survey, Denver, CO.
For primary bibliographic entry see Field 2E.
W86-04897

MORPHOLOGICAL INVESTIGATIONS ON THE LOWER SALZACH RIVER DOWNSTREAM OF SALZBURG,
Bayerisches Landesamt fuer Wasserwirtschaft, Munich (Germany, F.R.).
For primary bibliographic entry see Field 2J.
W86-04918

ECOLOGICAL IMPACTS OF THE CONSTRUCTION OF DAMS IN AN ESTUARY,
Rijkswaterstaat-Deltadienst, Middelburg (Netherlands). Hoofdafdeling Milieu en Inrichting.
J. Leentvaar, and S. M. Nijboer.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 181-191, 1986. 7 fig, 2 tab, 7 ref.

Descriptors: *Ecological effects, *Dams, *Estuaries, *Construction methods, Water resources development, Tidal hydraulics, Tides, Tidal effects, Biomass, Benthic environment.

The ecological impacts of alternative methods of constructing dams in an estuary are discussed. The main options available were: (1) using concrete blocks and rubble, and (2) using only sand. The advantages of using sand are that it is available locally and cheaper than concrete blocks and rubble. However, the application of sand in a tidal basin requires low current velocities. During the final closing period of a dam, these velocities can be reduced by using a storm-surge barrier (to be built in the mouth of the Eastern Scheldt estuary) in one of two ways: either reducing the tidal amplitude, or reducing the tidal frequency. Tidal reduction influences the vertical amplitude and current velocities, thereby decreasing the intertidal area, and in turn, the biomass and production of microphytobenthos and macrozoobenthos. A reduction of the horizontal tide leads to a reduction of the exchange of water between the North Sea and the estuary, decreasing current velocities. These phenomena affect the concentration of suspended and dissolved material. In particular, salt concentrations decrease with possible stratification. This paper describes the effects of these closing procedures on natural ecosystems and fisheries more fully. (Lantz-PTT)
W86-05371

SIGNIFICANCE OF ENVIRONMENTAL IMPACTS: AN EXPLORARION OF THE CONCEPT,
Dalhousie Univ., Halifax (Nova Scotia). Inst. for Resource and Environmental Studies.
P. N. Duinker, and G. E. Beanlands.
Environmental Management, Vol. 10, No. 1, p 1-10, January 1986. 1 tab, 37 ref.

Descriptors: *Environmental input statement, *Project planning, Social impact, Ecological effects, Canada.

Use of the term impact significance over the past 15 years in Environmental impact assessment (EIA) documentation is reviewed. Some recent attempts at elucidating the concept are summarized. Four perspectives on impact significance that emerged from a series of workshops on the ecological basis for EIA are as follows: (a) statistical (related to problems of isolated project-induced changes from natural variation), (b) ecological (re-

lated to the importance of project-induced changes from a purely ecological perspective), (c) szocial (related to the acceptability of project-induced changes in important environmental attributes), and (d) project (related to whether project-induced changes will indeed influence project decision making). The following synthesis is proposed: Any exercise in judging the impact should thoroughly consider (a) The importance of the environmental attribute in question to project decision makers, (b) the distribution of change in time and space, (c) the magnitude of change, and (d) the reliability with which change has been predicted or measured. (Peters-PTT)
W86-05410

7. RESOURCES DATA

7A. Network Design

METHOD FOR USING COMPUTERIZED CUSTOMER INFORMATION IN WATER DISTRIBUTION NETWORK MODELS,
Newcastle and Gateshead Water Co., Newcastle-upon-Tyne (England).
For primary bibliographic entry see Field 7B.
W86-04749

DETERMINATION OF A MEASURING NETWORK ALONG RIVERS,
Technische Hogeschool Delft (Netherlands). Dept. of Civil Engineering.
P. Klote van der, H. Niet de, and A. G. Posthumus.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 305-319, 8 fig, 5 tab, 3 ref.

Descriptors: *Networks, *Water level, *Flow velocity, *Flow measurements, *Flow pattern, *Algorithms, Mathematical models, Mathematical studies, Rivers, Filters, Models, Hydrometry.

During the last decade much attention has been given to the question of optimizing data networks, probably due to the trade-off between required quality and cost. For the situation of a measurement system along a river one of the objectives of the network is that water levels and velocities can be interpolated within a desired accuracy from the available data. If this situation is obtained, a further question is to consider the possibility of dropping one or more measurement stations along the river. In this paper the last question is answered for the river IJssel in the Netherlands using a Kalman filter algorithm. A preliminary step in using this algorithm is the determination of the model for the flow pattern in the river. With knowledge of this model and the given fact of available data in measuring stations along the river IJssel, calculations have been performed to show the effect of neglecting existing information in one or more points. By means of these calculations and a criterion on wanted accuracy some idea can be given on the value of the measured information. (See also W86-04785) (Author's abstract)
W86-04811

ADVANCED HYDROLOGIC INSTRUMENTATION ACTIVITIES WITHIN THE WATER RESOURCES DIVISION OF THE US GEOLOGICAL SURVEY,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W86-04815

DATA REQUIREMENTS FOR SEDIMENT, EROSION AND TRANSPORT SIMULATION,
University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering.
G. Fleming, and S. Fattorelli.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 321-327, 2 fig, 1 tab, 5 ref.

Descriptors: *Sediment transport, *Erosion, *Computer models, *Model studies, Deposition, Sediment deposition, Universal Soil Loss Equation, Strathcycle sediment model.

The computer simulation of sediment, erosion, transport, and deposition processes has developed considerably, but limited discussion has taken place on the data requirements for the various models available. This paper starts with a review of the techniques available for assessing sediment processes. The main theme of the paper is the intercomparison of data requirements for each assessment technique. This comparison explores the relevance of the output obtained from the assessment. For example, the accuracy of the input data to the Universal Soil Loss Equation and the relevance of the output to the real problem of soil loss tolerance assessment, is compared to the accuracy of the input to the Strathclyde sediment model and the relevance of its output to the same problem. Several methods are considered and recommendations made of future data needs. (See also W86-04843) (Author's abstract)
W86-04876

SPATIAL AND TEMPORAL VARIATIONS IN EROSION MEASUREMENTS,
Alberta Univ., Edmonton. Dept. of Geography.
I. A. Campbell.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 447-456, 4 fig, 3 tab, 24 ref.

Descriptors: *Erosion, Spatial variation, Temporal variation, Red Deer River, Alberta, Badlands, Soil erosion, Soil loss, Canada.

In 1969 nine erosion study sites were installed in the Red Deer River badlands of Alberta, Canada. A decade of data collection and 4500 point measurements show mean erosion rates of the order of 4.00 mm/year. This is considerably in excess of the estimated geological norm for this region (0.021-0.04 mm/year). Computer-simulated time lapse analyses of the data reveal short term sporadic pulses of erosional activity marked by distinct thresholds. These are separated by longer periods of relative inactivity. The 10-year study shows that prolonged periods of very detailed field measurement are required for the collection of reliable data since, even in geologically rapidly changing environments, such as badlands, relatively little change occurs for most of the time. Moreover, processes that appear erratic or sporadic in the short-term may be part of a steady trend over a longer time span. The results suggest the creation of a remarkably consistent pattern of change over a wide range of slopes and lithologies. (See also W86-04843) (Author's abstract)
W86-04887

ESTABLISHMENT OF EXPERIMENTAL PLOTS FOR STUDYING RUNOFF AND SOIL LOSS IN THE ROLLING LOESS REGIONS OF CHINA,
Yellow River Conservancy Commission, Zhengzhou (China). Inst. of Hydraulic Research.
For primary bibliographic entry see Field 2J.
W86-04889

STRATEGY FOR DESIGN OF MARINE POLLUTION MONITORING STUDIES,
SEAMOcean, Inc., Wheaton, MD.
For primary bibliographic entry see Field 5G.
W86-05353

DEVELOPMENT, TESTING AND INTERCALIBRATION OF REFERENCE METHODS FOR POLLUTION STUDIES IN COASTAL AND ESTUARINE WATERS,
International Lab. of Marine Radioactivity, Monaco-Ville (Monaco).
For primary bibliographic entry see Field 5C.
W86-05354

ANALYTICAL QUALITY CONTROL (AQC) FOR MONITORING TRACE METALS IN THE COASTAL AND ESTUARINE ENVIRONMENT,
Water Research Centre, Marlow (England).
For primary bibliographic entry see Field 5G.
W86-05355

STANDARDIZATION OF WATER QUALITY INFORMATION IN A TIDAL RIVER,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W86-05356

7B. Data Acquisition

RELATION BETWEEN L-BAND SOIL EMITTANCE AND SOIL WATER CONTENT,
Agricultural Univ., Wageningen (Netherlands).
L. Stroosnijder, R. J. Lascano, C. H. M. van Bavel, and R. W. Newton.
Remote Sensing of Environment RSEEA7, Vol. 19, No. 2, p 117-125, April 1986. 2 tab, 2 fig, 18 ref.

Descriptors: *Remote sensing, *Soil water, *Moisture content, *Radiometry, Soil texture, Soil emittance, Dielectric constant, Volumetric moisture content.

An experimental relation between soil emittance (E) at L-band and soil surface moisture content (M) is compared with a theoretical one. In order to convert emittance values, as derived from remote sensing, into water content values it does not seem necessary to determine the E-M relation experimentally for all soil types. An estimate of the clay percentage of the soil within 10 percent should suffice to calculate the volumetric moisture content of the top 0-2 cm with 0.02 cu m per cu m accuracy. If the estimated values of M are used in a hydrological model, in which the soil hydraulic properties also have to be known or estimated, the requirement of knowing the clay fraction within 10 percent is not restrictive. The soil dielectric constant is a function of both soil moisture content and of soil texture. (Peters-PTT)
W86-04688

SATELLITE THERMAL OBSERVATION OF OIL SLICKS ON THE PERSIAN GULF,
Japan Marine Science and Technology Center, Yokosuka.
I. Asanuma, K. Muneyama, Y. Sasaki, J. Lisaka, and Y. Yasuda.
Remote Sensing of Environment RSEEA7, Vol. 19, No. 2, p 171-186, April 1986. 3 tab, 3 fig, 17 ref.

Descriptors: *Remote sensing, *Oil slicks, *Satellite technology, *Radiometry, *Persian Gulf, Seawaters, Thermal channel, Thermal inertia, Sea surface temperature, Diurnal variation.

The images of the Advanced Very High Resolution Radiometer (AVHRR) carried on the NOAA-7 were collected from the end of March 1983 to the beginning of July 1983 for the detection of oil slicks on the Persian Gulf. The visible channels showed the possibility of detecting smog from the Nowruz oil fields. The thermal channel showed the distribution of sea surface temperature obtained after the atmospheric correction using the empirical equation by two thermal channels. The apparent thermal inertia, computed from the difference of sea surface temperature between the daytime and the nighttime, showed the possibility of oil slick detection, where it was difficult to detect oil slicks from the temperature difference between oil slicks and sea water in one observation. The apparent thermal inertia was computed on several points which may correspond to the same target among continuous observations. As a result, oil slicks showed a small apparent thermal inertia and sea water showed a large one. This means that oil slicks have smaller resistance to thermal change than sea water. Sea surface temperature used for computing the apparent thermal inertia was obtained through an atmospheric correction with an empirical equation which uses an energy difference between two thermal channels of the AVHRR.

Although there was an ambiguity on the selection of the same object on a water body, the computed apparent thermal inertia showed the possibility of oil slick detection from sea water. (Peters-PTT)
W86-04689

METHOD FOR USING COMPUTERIZED CUSTOMER INFORMATION IN WATER DISTRIBUTION NETWORK MODELS,
Newcastle and Gateshead Water Co., Newcastle-upon-Tyne (England).
D. G. Shore.
Institute of Water Engineers and Scientists, Journal, Vol. 40, No. 2, p 131-138, April 1986. 1 fig, append.

Descriptors: *Networks, *Computer models, *Metered consumption, *Water company, *England, Watnet simulation program, Computer programs, Urban areas, Rural areas.

The Watnet Simulation Program was developed by the Newcastle and Gateshead Water Company (United Kingdom), for determining and maintaining base load information used in the network analysis of water distribution systems. The method utilizes customer records to assess the number of unmetered connections and annual metered consumption within load areas defined by network models. The postal code of each customer is used as the geographical reference between network models and the customer data base. In an urban area examined, the number of open connections within the area was found to be within 1% of that determined by traditional physical counting of houses. In a rural area, the computerized system produced a lower number of unmetered connections than a physical count. An appendix lists the computer programs developed by the water company, including their language, purpose, input, output, and operation. (Rochester-PTT)
W86-04749

ADVANCES IN HYDROMETRY.
Institute of Hydrology, Wallingford (England).
Available from the IAHS, 2000 Florida Ave., NW, Washington, DC. 20009, Price: $30.00. IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. Edited by J.A. Cole. 359 p.

Descriptors: *Hydrometry, *Hydrometers, *Tracers, *Discharge measurement, *Networks, Gages, Flowmeters, Flow velocity, Mathematical models, Satellite technology, Bubble gages.

This symposium was organized by the International Association of Hydrological Sciences' International Commission on Surface Water and sponsored by the World Meteorological Organization (WMO). WMO is concerned with the establishment of hydrometric networks and the collection and application of hydrometric data, in particular in relation to its Hydrological Operation Multipurpose Sub-program (HOMS). The symposium presents 32 papers covering the following six topics: discharge measurement by the current metering and by gauging structures, discharge measurement by the moving boat and related techniques, float and tracer techniques, discharge measurement by ultrasonic and electromagnetic techniques, hydrometry in the electronic age, and regional hydrometry. (See also W86-04786 thru W86-04815) (Geiger - PTT)
W86-04785

HYDROMETRIC CABLEWAYS IN THE YANGTZE VALLEY,
Yangtze Valley Planning Office, Wuhan (China).
C. Youlie, and Z. Guozhen.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 7-17, 7 fig, 2 tab, 3 ref.

Descriptors: *Stream discharge, *Discharge measurement, *Stream gages, *Flashy streams, *Hydrometric cableways, Flow discharge, Hydrometry, Sediment discharge, Remote sensing, Measuring instruments, Yangtze Valley.

The hydrometric cableway is the principal measuring device in the Yangtze Valley for the gaging of discharge in deep, swiftly flowing, and violently fluctuating streams. This paper describes technical problems which have to be studied and resolved when the cableway is used. Topics covered are the layout of the cable, principles and methods of depth measurement using a sounding weight, methods for eliminating the effects of cable vibration, signal transmission and remote operation for velocity, depth, and sediment measurements. Correction for oblique angle of suspension of the cable takes into consideration the droop of the main cable, the rise of the hanging point, and the variation of curve length. Use of the powered winch and silicon controlled speed regulator eliminates cable oscillation and increases accuracy of positioning and measuring. In order to apply the ultrasonic sounding method to cableways, some problems need to be recognized. The insulated wire used for conducting sound impulses suffers extraneous influences of water flowing past it. The echo sounder can be used for both measuring water depth of verticals and positioning observation points. It is also difficult to position observation points in shallow streams. To solve the above problems, water body and steel cable are used as the conducting circuit. (See also W86-04785) (Geiger - PTT)
W86-04786

FLOW MEASUREMENT IN OPEN AND CLOSED CONDUITS OF GRAVITATIONAL URBAN STORM SEWER NETWORKS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
A. Borzsonyi.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-20, 1982, Exeter, England. p 19-23, 2 fig, 2 ref.

Descriptors: *Unsteady flow, *Storm sewers, *Flow measurement, *Flowmeters, *Telemetry, Sewers, Sewer systems, Flow rates, Flow discharge, Conduits, Hydrometers, Hydrometry, Hydrometric equipment.

The analytical investigation of unsteady flow phenomena in gravitational urban sewer networks is essential for the proper dimensioning, hydraulic analysis and operation of the network. Regular records of measurement data form the basis of such investigations. The construction and functions of a computer-based automatic data collection system installed along a selected section of the storm sewer network at Pecs in South-Hungary are described. The system involves the telemetry of water levels, pressure heads and flow rates at specific points of the network, as well as of precipitation at six points in the basin. A structure of special design involving lateral constriction has been developed for the measurement of levels, heads and flow rates, which is equally suited to measurement in open and closed conduits. Provision had to be made for passing sediments and solid pollutants as well. The technique and evaluation of flow measurement in open and closed conduits are described. The data are computer-processed on the basis of calibrated rating curves. (See also W86-04785) (Author's abstract)
W86-04787

CURRENT METER CALIBRATION - INDIVIDUAL RATING VERSUS GROUP RATING,
Department of the Environment, Reading (England). Water Data Unit.
R. W. Herschy.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-20, 1982, Exeter, England. p 25-36, 3 tab, 10 ref, 3 append.

Descriptors: *Water metering, *Cost analysis, *Calibrations, *Water costs, Gages, Performance evaluation, Comparison studies, Error analysis, Hydrometric equipment.

The cost of the individual rating of current meters is expensive and is likely to increase substantially in the future. Both International and British standards make provision for current meters to be used with either an individual rating or a group rating. Previous work in this field by Lambie, Smoot, Carter, and Grindley are summarized. Joint conclusions confirm that the use of an individual rating for each meter, changing every time the meter is rated, cannot be justified, and the use of a rating derived from the mean of a fairly large group of ratings of different meters of the same type is preferred. Strict control of manufacturer's tolerances would be an essential requirement for the implementation of a group rating. The adoption of a group rating need not reduce the accuracy or current meter gagings; the cost saving of a group rating however is significant. (See also W86-04785) (Geiger - PTT)
W86-04788

UP-DATING OF DISCHARGE RATING CURVES BY MEANS OF MATHEMATICAL MODELS,
Institut fuer Wasserwirtschaft, Berlin (German D.R.).
A. Becker, M. Melcher, and G. Kose.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 37-48, 4 fig, 8 ref.

Descriptors: *Mathematical models, *Discharge measurement, *Flow discharge, *Streamflow forecasting, *Mathematical studies, Models, Flow measurement, Discharge hydrographs, Gages, Streamflow, Rivers, Running waters, Routing.

A centralized computerized streamflow forecasting system was developed for the River Elbe and for the downstream reaches of its main tributaries in the GDR to provide daily streamflow forecasts for up to 23 gaging stations. An appropriate combination of precise flow measurements at selected well-established river gaging stations with flow computations along the river by means of mathematical models (streamflow routing techniques) aided in monitoring and up-dating discharge rating curves at all gaging stations along the river. It also allowed for extrapolation of results of precise flow measurements performed at one or a few selected stations, under critical flood conditions, to neighboring stations, and helped to avoid water balance discrepancies along the river. (See also W86-04785) (Geiger - PTT)
W86-04789

METHOD FOR UNIFORMIZING THE STAGE-DISCHARGE RELATIONS OF STABLE RIVER BEDS AND ITS APPLICATION,
Yangtze Valley Planning Office, Wuhan (China).
G. Weiya, L. Xueqi, and T. Peiwen.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 49-61, 1 fig, 4 tab.

Descriptors: *Discharge hydrographs, *Discharge measurement, *River beds, *Mathematical models, *Uniformity coefficient, Hydrometry, Gaging stations, Gaging, Regression analysis, Mathematical studies, Automation, Data processing, Computers, Stage-discharge relations, Stages.

A parabolic optimum mathematical model for uniformizing the stage-discharge relations of stable river beds is presented and applied to methods of automatic processing and simplification of data collection at gaging stations. A hyperbolic simulation model and a multivariate linear stepwise regression optimum model for performing the same functions are also described. The objects of uniformizing the complex rating curves for stable river beds are those of giving a clear conception, of providing a simple appropriate adjusting method, and of taking this method as a basis for solving the principle problems concerned in automatic processing. Uniformization provides a basis for reducing the number of measurements and makes continuous-record stations obsolete, or changes them into

record stations where data at yearly intervals are collected. Uniformization makes it possible to improve the measurement of discharge and allows gaging stations to be visited only periodically in sequence. It also privdes a new way of simplifying the complex loop rating for hydrological design and forecasting. (See also W86-04785) (Geiger - PTT)
W86-04790

EQUATIONS FOR ESTIMATING DISCHARGE IN STEEP CHANNELS WITH COARSE BED MATERIAL,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W86-04791

MULTILAYER WIDTH-INTEGRATED VELOCITY MEASUREMENT METHOD,
Fujian Provinicial Hydrometric Station, Fuzhou (China).
C. Rihua.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 75-85, 3 fig, 2 tab.

Descriptors: *Flow velocity, *Flow measurement, *Hydrometry, *Mathematical studies, Flow profiles, Flow characteristics, Mathematical models, Flowmeters, Gages, Running waters, Rivers.

The multilayer width-integrated velocity measurement method (MVIVMM) is an innovation in current meter design. The cross section of the river is divided into 4 or 5 layers: the meter (which is suspended from a cable) is drawn across each layer at a constant rate while it makes continuous with-integrated velocity measurements. This contrasts with the standard method in which velocities are determined at fixed points along a series of verticals. The MWIVMM has the advantage of measuring the mean velocity of each individual layer of the cross section: since the operation saves about two-thirds of the time needed for the standard method it may prove an attractive competitor, especially on rivers with rapidly changing stages. (See also W86-04785) (Author's abstract)
W86-04792

MOVING BOAT DISCHARGE MEASUREMENTS USING ACOUSTIC DOPPLER TECHNIQUES,
Geological Survey, NSTL Station, MS. Gulf Coast Hydroscience Center.
V. R. Schneider, and R. H. Billings.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 87-92, 5 ref.

Descriptors: *Acoustics, *Flow discharge, *Flow measurement, *Boats, *Flow velocity, Hydrometry, Discharge hydrographs, Discharge measurement, Flowmeters, Rivers, Running waters.

Moving-boat techniques using conventional equipment have been tested and established. Discharge is computed on the basis of cross-section geometry, current meter readings, and flow angles relative to shrore-based targets. Recent developments in acoustic Doppler technology promise a new and potentially superior approach. The acoustic system uses a single transducer array to probe the water column beneath a moving boat and processes echoes from the water mass and bottom into sectional area and velocity measurements. Total discharge across a straight line between the starting and ending points of the boat travel is computed by integration. Feasibility tests are being conducted in the Mississippi River near Baton Rouge, Louisiana. Discharge measurements will be independently made with current meter, conventional moving boat, and acoustic Doppler techniques. (See also W86-04785) (Author's abstract)
W86-04793

DEVELOPMENTS IN HYDROMETRY IN INDIA,
Central Water Commission, New Delhi (India).
S. K. Haldar.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 93-100, 4 fig, 1 tab.

Descriptors: *Flood discharge, *Flood hydrographs, *Flow discharge, *India, *Indirect flood measurement, *Discharge measurement, Discharge hydrographs, Hydrometry, Flowmeters, Flow measurement, Flood profiles, Flow velocity, Mannings equation, Chezy equation, Running waters, Manning's equation.

Measurement of high flood discharge in India is subject to many complications. The most difficult operation while observing high discharge is: the accurate positioning of the boat at the point of measurement, accurate determination of depth, and placing the current meter at the point of measurement in the vertical. A high-powered motor launch has been provided at almost all the important measurement sites. Fish weights are used whenever it is possible to measure the depth by suspension cable and weights. Correction factors are used to compensate for drift of the boat. Discharge measurements by the moving-boat method are conducted at some of the important sites during flood periods and experience has shown that this method is both quick and reliable. When the river is in high flood and it is extremely difficult to enter the river either with the held of motor launch or cable-way, the velocity is measured with the help of floats. Indirect peak discharge estimation is usually carried out by the slope-area method. In India, Manning's equation is used for estimation of discharge on account of its simplicity. (See also W86-04785) (Geiger - PTT)
W86-04794

DESIGN AND STUDY OF THE INSTRUMENTATION REQUIRED FOR THE MEASUREMENT OF DISCHARGE BY THE MOVING BOAT METHOD,
Water Conservancy Hydroelectric Power Scientific Research Inst., Beijing (China).
W. Hongli.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 101-108, 3 fig, 1 ref, 1 append.

Descriptors: *Discharge measurement, *Flow discharge, *Flow measurement, *Flow velocity, *Flowmeters, Discharge hydrographs, Hydrometry, Design criteria, Gages.

The instruments and equipment developed for the measurement of discharge by the moving boat method are described and compared with those in ISO-4369; future development is also discussed. The basic equipment consists of a propeller-type current meter with a photo-electric velocity sensor which generates 24 pulse signals for a turn, an angle indicator with a magnetic synchronous inductor, and an improved echo sounder. The remaining instrumentation is automatic, and includes simultaneous operation and synchronous recording. (See also W86-004785) (Author's abstract)
W86-04795

FLOOD FLOW GAUGING WITH TRITIUM IN SOUTHERN AFRICA,
Ministry of Water Development, Salisbury (Zimbabwe). Hydrological Branch.
P. Wurzel, and P. R. B. Ward.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 119-128, 3 fig, 2 tab, 11 ref.

Descriptors: *Tritium, *Radioactive tracers, *Flood hydrographs, *Rivers, *Flood profiles, Hydrometry, Gages, Flood forecasting, Tracers, Running waters, Ward's equation.

Tritiated water has been in routine use for a number of years in Zimbabwe for measuring flood flows by the dilution method. The advantages of using the dilution method instead of current meter gagings in the kinds of ephemeral rivers, with difficult access that exist in Zimbabwe, are the availability of a liquid scintillation counter and a trained technician for carrying out the measurements, and the low cost of the tritiated water compared to other chemicals. Tritiated water ampules, housed in a small cartridge, are shot into midstream by the use of a mortar. Samples are taken at regular intervals at predetermined sampling stations. Approximate rules for forecasting tracer arrival times and tracer transit durations are useful in planning the execution of the measurements. Ward's equation is used to compute mixing distances and is found to give good approximate predictions of desirable injection point to sampling point distances. (See also W86-04785) (Geiger - PTT)
W86-04796

TRACER MEASUREMENTS IN LOWLAND RIVERS,
Vrije Univ., Brussels (Belgium). Lab. of Hydrology.
W. Bauwens, J. Bellon, and A. van der Beken.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 129-139, 5 fig, 2 tab, 12 ref.

Descriptors: *Tracers, *Dye releases, *Adsorption, *Alluvium, *Organic matter, *Rivers, Sediments, Fluvial sediments, Flow discharge, Flow velocity, Discharge measurement, Mathematical equations, Hydrometry, Running waters.

Comparative travel time measurements were carried out in a river with alluvial sediment and organic material to study the influence of adsorption of fluorescent tracers on the travel time determination. Three types of dyes were used: rhodamine B, rhodamine WT and sulpho-rhodamine B. The results show that adsorption can influence the travel time derived from the concentration curve, especially if the centroid of this curve is used. The relationship between discharge and velocity was examined. For higher discharges the velocity tends to a limit. Measured and calculated values of effective dispersion coefficients are compared. (See also W86-04785) (Geiger - PTT)
W86-04797

TWO LESS CONVENTIONAL METHODS OF FLOW-GAUGING,
Leicester Univ. (England). Dept. of Engineering.
P. H. John, F. A. Johnson, and P. Sutcliffe.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 141-152, 2 fig, 2 tab, 22 ref.

Descriptors: *Gaging, *Flow measurement, *Automation, *Flowmeters, *Flow velocity, Hydrometry, Gages, Floats, Bubble gages, Streamflow, Running waters.

The recent development of the integrating float and salt-velocity flow-gaging methods is discussed. The results of tests relating to precalibration of plastic floats and of field trials using both the single and two-float techniques are presented. It is concluded that if solid floats are used, precalibration may be employed with confidence, integrating float gagings comparing favorably with those obtained by current meter. However, in view of some problems associated with the application of this technique in natural channels, the use of air bubbles is examined. This method has considerable potential but requires some further investigation. Two new automated forms of the salt-velocity technique are described and the results of laboratory tests presented. These show that although slightly less accurate than some other salt-velocity techniques, these automated methods have the advantage of being portable and giving velocity data quickly. (See also W86-04785) (Author's abstract)
W86-04798

RISING AIR FLOAT TECHNIQUE FOR THE MEASUREMENT OF STREAM DISCHARGE,
Lancaster Univ., Bailrigg (England). Dept. of Environmental Sciences.
D. M. Sargent.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 153-164, 3 fig, 1 tab, 4 ref.

Descriptors: *Streamflow, *Flow measurement, *Gaging, *Floats, *Bubbles, Discharge measurement, Discharge, Flow discharge, Flowmeters, Automation, Gages, Flow velocity.

A simple, practical method of stream flow measurement has been developed that is based on the integrating float technique using air bubbles as rising integrating floats. The field equipment consists of a flexible rubber air supply pipe fitted with nozzles. The photographic method of data capture for subsequent analysis using a micro-computer is described. Field use and a number of field applications ranging from rivers of 20 m to 100 m width, slow moving canals, and concrete channels are considered. Current work on the method includes the possibility of automation using a television camera. Some advantages and limitations of the technique are discussed. The present method offers a real alternative to the velocity area method, particularly as it produces measurements of instantaneous discharge, and it can be used in some situations in which gaging is not possible using traditional techniques. (See also W86-04785) (Geiger - PTT)
W86-04799

INSTALLATION AND OPERATION OF A BUBBLE GAUGE NETWORK IN THE MAHAKAM RIVER BASIN, EAST KALIMANTAN, INDONESIA,
German Agency for Technical Cooperation, Frankfurt am Main (Germany, F.R.).
T. N. Woods, and E. Wachjan.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 165-172, 3 fig, 4 ref.

Descriptors: *Bubble gages, *Water level recorders, *Gages, *River basins, *Automation, Hydrometry, Hydrologic data collections, Networks, Water resources development, Hydrometric equipment, Hydraulic equipment.

A network of automatic water level recording stations has been installed in the Mahakam River Basin to provide water resources data for planning of Transmigration (Resettlement) and Area Development Programs and to monitor the environmental problems of flooding, erosion and sedimentation associated with large scale clearing of primary forests. The topography and instability of the river sections led to the selection of bubble gage recorders and the use of piled timber supports for staff gages at 13 locations. The SEBA Bubbler Gage Omega with a modified chart recorder was selected. This instrument was housed in wood and mounted on stilts on the top of the bank. The instrument casing was secured to the inside wall of the house by means of a clamp. The orifice was generally placed at a minimum depth of 0.5 m below the estimated lowest water level. In the absence of any main supply, 5 volt DC batteries were used to power the instrument at each location. The feed pressure to the instrument is controlled by a reducing valve. The thirteen stations equipped with bubble gages were manned by field observers and visited monthly by hydrological technicians. The network was administered from a project office at Kotabangun in the mid-catchment area. (See also W86-04785) (Geiger - PTT)
W86-04800

DETERMINATION OF THE ACCURACY OF WATER LEVEL OBSERVATION,
Rijkswaterstaat, The Hague (Netherlands).
J. W. Made van der.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England, p 173-184, 12 fig, 1 ref.

Descriptors: *Water level recorders, *Water level, *Multiple regression analysis, *Error analysis, *Rivers, Water level equipment, Hydrometry, Mathematical studies, Gages, Gaging, Hydrometric equipment, Statistical analysis.

The accuracy of a water level observation, expressed by its standard deviation, is influenced not only by the recording instrument itself but also by the situation and the conditions at and around the station. Some external factors affecting the results are: levelling errors; differences in level between the open water and the stilling well; influences of observation time; instrumental inaccuracies; influences of the situation of the gaging station; errors due to observation and digitizing; processing errors; and unclear definitions of the concept of true water level. The standard deviation cannot be derived from local observations only, because of the real movements of the water stage. Methods of deriving the standard deviation (inaccuracy) from neighboring stations, using simple multiple regression, are described. It appears that the standard deviation of water level observations in rivers can amount to several centimeters. (See also W86-04785) (Geiger - PTT)
W86-04801

IMPROVEMENT OF ULTRASONIC FLOWMETER IN RIVERS IN JAPAN,
National Research Center for Disaster Prevention, Sakura (Japan).
T. Kinosita.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 187-202, 12 fig, 6 ref.

Descriptors: *Flowmeters, *Flow measurement, *Ultrasonics, *Japan, *Stage-discharge relations, *Discharge measurement, Hydrometry, Flow, Rivers, Tidal rivers, Networks, Hydrologic data collections, Hydrometric equipment.

Ultrasonic flowmeters have already been successfully implemented in rivers in Japan. There is good agreement between the traditional method using current meters and the ultrasonic method. Direct continuous measurement is often necessitated in areas of high water, on tidal rivers, and at outflow from a lake. Improvements have been made concerning cable crossings, interference caused by temperature extremes, interference caused by noise, and ultrasonic velocity changes. Hydraulic characteristics of river flow based on continuously measured discharge are discussed, and these characteristics are useful in providing guidelines for hydrometric network systems. (See also W86-04785) (Geiger - PTT)
W86-04802

EXPERIENCES GAINED DURING THE HYDRAULIC INVESTIGATIONS ON THE COOLING WATER SYSTEM OF A THERMAL POWER STATION,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 8C.
W86-04803

MEASUREMENT OF OPEN CHANNEL FLOW BY THE ELECTROMAGNETIC GAUGE,
Department of the Environment, Reading (England). Water Data Unit.
R. W. Herschy, and J. D. Newman.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 215-227, 10 fig, 1 tab, 4 ref.

Descriptors: *Gages, *Flowmeters, *Flow measurement, *Electromagnetic waves, *Channel flow, Channels, Hydrometry, Gaging, Automation, Flow discharge, Discharge measurement, Flow, Performance evaluation, Sewers, Culverts, Hydraulic equipment.

Since 1975, significant improvements have been made to the electromagnetic gage for measuring flows in open channels. These improvements have been mainly in the instrumentation. The principle of operation of the gage and the main criteria for site selection for an electromagnetic gaging station are described. The site calibration of an electromagnetic gage requires the establishment of the relation of discharge as found by current meter, or other means, to the variables for electrode voltage, depth of flow, and coil current. The coil of the gage may be installed in covered U-section ducts, or pipes. The electromagnetic gage may be used in gaging flow in sewers and culverts. In this application a prefabricated pipe of glass reinforced plastic is lowered into a manhole or access shaft and coupled to the pipeline. Performance tests of the gage on rectangular channels show the method to be reliable with an uncertainty of the order of 2%. The instrumentation of the process is based on a microprocessor bus-bar system which gives a high degree of flexibility in providing output options. A software and hardware sub-routines so that where software extensions are needed additional modules may be plugged in. (See also W86-04785) (Geiger - PTT)
W86-04804

HYDROMETRIC DATA CAPTURE USING INTELLIGENT SOLID STATE LOGGING SYSTEMS,
Severn-Trent Water Authority, Birmingham (England).
S. T. Walker.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 229-237.

Descriptors: *Hydrometry, *Computers, *Gages, *Monitoring, *Hydrologic data collections, Gaging, Ultrasonics, Electromagnetic waves, Rain gages, Remote control, Data acquisition, Automation, Hydrometric equipment.

From small beginnings with relatively simple rainfall event recorders, the use of solid state logging technology has expanded steadily within the Severn-Trent Water Authority hydrometric service. Ultrasonic and electromagnetic river flow measuring systems now record on intelligent microprocessor driven devices, instead of on the traditional punched paper tape. Further variants with increased versatility have been developed and are undergoing field trials. These include devices with built-in facility to monitor continuously, but record data only when predetermined threshold values are exceeded, or indeed, to record only significant changes in the state of a variable. The concept of the 'electronic notepad' has been introduced successfully into current meter gaging and shows promise for use in other hydrometric fields. In all cases, great attention has been paid to the human engineering' of the devices, and satisfying success has been achieved in making them easily usable by staff previously experienced only with traditional hydrometric equipment. (See also W86-04785) (Author's abstract)
W86-04805

FLOW MEASUREMENT AT SEWAGE TREATMENT PLANTS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
I. Mayer.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 241-245, 3 fig.

Descriptors: *Flow measurement, *Flowmeters, *Wastewater facilities, *Canals, *Flow rates, Flow discharge, Flow, Process control, Hydrometry, Hydrometric equipment.

Flow rates in open canals are measured almost exclusively by devices registering the headwater

level of shooting flow created by a constriction. At sewage treatment plants the sensing devices situated along the measuring constriction are susceptible to clogging, corrosion and to becoming inoperative, owing to the chemical, bacterial, or radiation effects of the substances present in the water. These difficulties were overcome by a measuring tube continuously flushed with fresh water. This is a substantially perforated tube in which the flushing water flows toward the sewage. The surface of the flushing fresh water in the tube rises - as in communicating vessels - to the same height as the surface of the sewage to be measured. In this way a fresh-water measuring station is achieved in the sewage. A teflon-coated sensing device is installed at the measuring station. The transmitted are transformed by micro-processors and a calculator into digital and graphical printouts indicating the actual flow rate, and the total volume up to the time of measurement. (See also W86-04785) (Author's abstract)
W86-04806

MONITORING WATER QUANTITY AND WATER QUALITY IN AN URBAN BASIN,
F. H. M. Ven van de.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IASH, July 19-30, 1982, Exeter, England. p 247-256, 6 fig, 3 ref.

Descriptors: *Water quality, *Water supply, *Urban drainage, *Catchment areas, *Monitoring, Hydrometry, Flow measurement, Computers, Automation, Hydrologic data collections, Flowmeters, Sampling, Hydrometric equipment, Water quality control, Water quality management, Canals.

A new urban drainage basin has been equipped in Lelystad for monitoring of both water quality and water quantity. Measurements of flow and the water quality parameters are performed continuously at the outfall of the stormwater drain and at three points in the receiving water body - a canal. A sampler is also installed at the outfall. The monitoring equipment is connected to a computer-controlled data logging system by a common carrier interface. On-line data reduction is performed by the logger, while the sampler takes either grab samples or collected samples. The quantitative variables are measured simultaneously with two instruments for a higher degree of reliability and accuracy. The qualitative monitors are regularly recalibrated and are kept under a strict preventive maintenance schedule. (See also W86-04785) (Author's abstract)
W86-04807

HADDINGTON FLOOD WARNING SYSTEM,
Institute of Hydrology, Wallingford (England).
G. P. Brunsdon, and R. J. Sargent.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 257-272, 5 fig.

Descriptors: *Flood forecasting, *Models, *Rainfall-runoff relationships, *Automation, *Flow measurement, Flood hydrographs, Flood plain management, Hydrologic data collections, Monitoring, Hydrometry, Computers, Rain gages, Hydrologic models, Data acquisition.

The data acquisition system described in this paper is described for forecast floods in the Haddington region which is located 25 km east of Edinburgh in Scotland. The instrumentation is compact, simple to operate, exploits modern microprocessor technology and is fully automatic. Low cost, good reliability and minimal maintenance requirements were factors considered during design. The system collects river flow and rainfall data, computes the catchment's response using a rainfall/runoff model and automatically updates a remote monitor with flow predictions and maintenance alerts. It is thus particularly suited to flood warning schemes where 24-hr manning cannot be provided and is specifically designed to operate on steep catchments where upstream river correlation cannot give sufficient warning. (See also W86-04785) (Author's abstract)
W86-04808

SATELLITE DATA AS BASIS FOR THE ESTIMATION OF RAINFALL AND RUNOFF,
Bochum Univ. (Germany, F.R.).
L. R. Kruger, G. Strubing, and G. A. Schultz.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 273-284, 10 fig, 7 ref.

Descriptors: *Satellite technology, *Rainfall, *Runoff, *Remote sensing, *Infrared imagery, Hydrologic data collections, Hydrometry, Rainfall-runoff relations, Data acquisition, Hydrologic models, Clouds.

Remote sensing techniques are increasingly applied in order to acquire hydrological data. Particularly in developing countries (where often no hydrometric data are available) remote sensing techniques based on satellite imagery may be valuable for design or operation of water resources systems. Two techniques for the application of satellite imagery in hydrology are presented. The first shows a method for the estimation of rainfall volumes from infrared imagery of a geostationary satellite providing information of the time-dependent change of cloud surface temperature and cloud area. On the basis of these parameters a mathematical model is developed which computes rainfall volumes. This technique is not yet operational, but in principle it can be used for runoff estimation from images of a polar orbiting satellite using an indexing technique. This method allows the direct estimation of monthly runoff values from daily infrared images. The method could eventually be applied for the generation of hydrological design data. (See also W86-04785) (Author's abstract)
W86-04809

TOWARDS A SATELLITE-BASED HYDROMETRIC DATA COLLECTION SYSTEM,
Department of the Environment, Reading (England). Water Data Unit.
R. W. Herschy.
IN: Advances in Hydrometry, IAHS, July 19-30, 1982, Exeter, England. p 285-296, 3 fig, 1 tab, 4 ref.

Descriptors: *Satellite technology, *Hydrologic data collections, *Telemetry, *Hydrometry, *Meteorological data collection, Discharge measurement, Networks, Data acquisition, Remote sensing, Data transmission, Gaging, Cost analysis.

Water level and discharge data for the United Kingdom streams and rivers are at present punched on to paper tape. This system involves delay, and the equipment is due for replacement. The use of satellite telemetry is considered as an alternative. The types of Data Collecting Platforms (DCPs) available include self-timed units where the data are transmitted in buffered blocks of data at fixed intervals, DCPs which provide an immediate alert transmission when a critical data value has been reached, and interrogable DCPs where the unit receives a command message from the control center via the satellite. The United Kingdom has investigated the data collection systems offered by the geostationary satellites and the METEOSAT earth receiving station. The United Kingdom pilot study showed the DCP to be a reliable and cost effective method of transmitting hydrological data. Some on-site pre-processing before transmission could be performed simply and conveniently by the DCP microprocessor. Use of the satellite system in conjunction with the WEFAX dissemination program is considered. Existing telemetry networks suffer from high installation and maintenance costs. The largest cost of a satellite system is the design, manufacture, launching and operation of the satellite. A satellite data collection system would appear to offer a cost effective replacement to the existing United Kingdom system of data collection. (See also W86-04785) (Geiger-PTT)
W86-04810

SPECIFIC HYDROMETRY OF KARST REGIONS,
Split Univ. (Yugoslavia). Faculty of Engineering.
For primary bibliographic entry see Field 2F.
W86-04812

DEVELOPMENTS IN HYDROMETRY IN CENTRAL AMERICA AND BRAZIL,
Projecto de Hidrologia e Climatologia da Amazonia, Belem (Brazil).
M. B. Dengo.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 335-344, 2 fig, 4 ref.

Descriptors: *Hydrometry, *Developing countries, *Hydrologic data collections, *River basins, *Telemetry, Data acquisition, Meteorological data collection, Discharge measurement, Flow discharge, Flow measurement, Flood forecasting, Networks, Hydrologic models, Tocatins River, Amazon River, Brazil, Costa Rica, Panama.

A general review of the developments in hydrometry in Central America in the 1970-1980 decade is given. Under the UNDP/WMO Central American Hydrometeorological Project, the number of meteorological and hydrological networks were increased in improved flow and flood-forecasting systems. Honduras has begun forecasting activities with a new telemetric network in the basin used for the El Cajon Hydroelectric Project. Panama and Costa Rica are also preparing telemetry stations in their networks. The Brazilian Project on Hydrology and Climatology of Amazonia (PHCA) has centered its activities along three main lines: the square-grid study to determine the minimum size of network capable of producing data of acceptable quality, and to create a physiographic-hydrometeorological data bank; the design, installation and oepration of a pilot telemetry network in the River Tocantins basin; and the mathematical modelling of the middle and lower Amazon River. Two techniques used by PHCA for stage-discharge relationship evaluation are discussed. For the calculation of discharge in backwater reaches, the backwater isolines method is used. A dynamic model has been implemented to represent the stage-discharge relationship in hysteresis loops. Both of these methodologies are computer-oriented and permit the automatic calculation of discharge. (See also W86-04785) (Geiger - PTT)
W86-04813

ADVANCED HYDROLOGIC INSTRUMENTATION ACTIVITIES WITHIN THE WATER RESOURCES DIVISION OF THE US GEOLOGICAL SURVEY,
Geological Survey, Reston, VA. Water Resources Div.
R. W. Paulson, R. H. Billings, and A. S. Cherdak.
IN: Advances in Hydrometry, IAHS Publication No.134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 353-359, 3 fig, 2 ref.

Descriptors: *Networks, *Hydrologic data collections, *Hydrometry, *Research priorities, *Gaging, *Monitoring, Sampling, Data acquisition, Data collection, Automation, Future planning, Data transmission, Data processing, Design criteria, Network design, Water sampling.

Primary responsibility for the USA's water data lies with the Water Resources Division of the U.S. Geological Survey. The Survey has identified a need for upgrading its water data-collection system in the field. A three-phase program is under way to define needs for field instrumentation and techniques, applicable technologies, and specific research and development plans. Two of the Survey's instrumentation projects are described, which fit into this program of upgrading technology. The first is a study of the time base of data sampling at fixed gaging stations. The second is the planning and development of a new field data acquisition system to replace the 12,000 to 15,000 mechanical punched-tape recorders now used in

the Survey network. (See also W86-04785) (Author's abstract)
W86-04815

EROSION AND SEDIMENT TRANSPORT MEASUREMENT: SYMPOSIUM.
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2J.
W86-04843

MEASUREMENT OF BED LOAD IN RIVERS,
Oregon State Univ., Corvallis. School of Forestry.
For primary bibliographic entry see Field 2J.
W86-04844

INCREASED BAG SIZE IMPROVES HELLEY-SMITH BED LOAD SAMPLER FOR USE IN STREAMS WITH HIGH SAND AND ORGANIC MATTER TRANSPORT,
For primary bibliographic entry see Field 2J.
W86-04845

EFFICIENCY OF BASKET TYPE BED LOAD SAMPLERS,
National Water Research Inst., Burlington (Ontario).
For primary bibliographic entry see Field 2J.
W86-04846

DEVELOPMENT OF A SAND BED LOAD SAMPLER FOR THE YANGTZE RIVER,
Yangtze River Planning Office, Hankou (China).
For primary bibliographic entry see Field 2J.
W86-04847

NUCLEAR TECHNIQUES FOR MEASURING SEDIMENT TRANSPORT IN NATURAL STREAMS, EXAMPLES FROM INSTRUMENTED BASINS,
Naples Univ. (Italy). Ist. di Geologia e Geofisica.
For primary bibliographic entry see Field 2J.
W86-04849

DEVELOPMENT OF NUCLEAR SEDIMENT CONCENTRATION GAUGES FOR USE ON THE YELLOW RIVER,
Yellow River Conservancy Commission, Zhengzhou (China). Inst. of Hydraulic Research.
For primary bibliographic entry see Field 2J.
W86-04850

LATEST ACHIEVEMENTS IN THE DEVELOPMENT OF NUCLEAR SUSPENDED SEDIMENT GAUGES,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 2J.
W86-04851

CONTINUOUS MEASUREMENT OF SUSPENDED SEDIMENT IN RIVERS BY MEANS OF A DOUBLE BEAM TURBIDITY METER,
Hydrological Research Inst., Pretoria (South Africa).
For primary bibliographic entry see Field 2J.
W86-04852

USE OF TURBIDITY MONITORS TO ASSESS SEDIMENT YIELD IN EAST JAVA, INDONESIA,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 2J.
W86-04853

ANALYSIS OF A SIMPLE SUSPENDED LOAD INTEGRATING SAMPLER,
Florence Univ. (Italy). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W86-04854

RECENT DEVELOPMENTS IN PUMP SAMPLERS FOR THE MEASUREMENT OF SAND TRANSPORT,
Hydraulics Research Station, Wallingford (England).
For primary bibliographic entry see Field 2J.
W86-04855

FIELD MEASUREMENTS OF SUSPENDED SEDIMENT CONCENTRATION IN THE SURF ZONE,
Polish Academy of Sciences, Gdansk. Inst. Budownictwa Wodnego.
For primary bibliographic entry see Field 2J.
W86-04856

IN SITU MEASUREMENTS OF PARTICULATE MATTER TRANSPORT IN RIVERS,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Siedlungswasserwirtschaft.
For primary bibliographic entry see Field 2J.
W86-04857

SEDIMENT MEASUREMENT TECHNIQUES USED BY THE SOIL CONSERVATION SERVICE OF NEW SOUTH WALES, AUSTRALIA,
Soil Conservation Service of New South Wales, Sydney (Australia).
For primary bibliographic entry see Field 2J.
W86-04858

SEDIMENT TRANSPORT SAMPLING FOR ENVIRONMENTAL DATA COLLECTION,
Water and Power Resources Service, Denver, CO.
E. L. Pemberton.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 159-167, 3 fig, 2 tab, 10 ref.

Descriptors: *Sediment transport, *Sampling, *Environmental effects, *Rivers, Suspended sediments, San Juan River, New Mexico, Trinity River, California, Smith's Fork River, Utah, Niobrara River, Nebraska, Einstein sampling procedure, River beds.

Case histories of sediment sampling for environmental concerns are described. Sampling programs varied, primarily because of the bed material composition. The collected sediment data consist of suspended sediment samples and channel hydraulic parameters for use in computing total sediment transport by the modified Einstein procedure. The rivers were as follows: San Juan River, New Mexico; Trinity River, California, Smith's Fork River, Utah; and Niobrara River, Nebraska. All were shallow, less than 1 meter. Sediment sampling was done with the rod sampler or handline using the equal width interval method. For the rivers with bimodal bed material (Gravel-cobble in both the quiescent reaches and the riffles or rapids and sand-size sediments intermixed with the larger material) both types of bed material were sampled. The coarser material was sampled with a square grid photograph, shovel sample for sieve analysis, or visually. Another problem with the bimodal beds was the number of samples required for good representation; sand requiring more samples. (See also W86-04843) (Cassar - PTT)
W86-04859

SEDIMENT SAMPLING IN RIVERS AND CANALS,
Uttar Pradesh Irrigation Research Inst. Roorkee (India).
H. S. S. Singhal, G. C. Joshi, and R. S. Verma.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 169-175, 3 fig, 6 ref.

Descriptors: *Sediment transport, *Sampling, *Bed load, *Suspended sediments, *Rivers, *Canals, India, Floods.

Sampling techniques for bed and suspended load observations in rivers and canals at both low and high velocity flows were studied at Roorkee, India. Bed load measurements were done with a pressure difference bed load sampler. This instrument had very high efficiency. In rivers suspended and bed load sampling was done at five verticals. However, in canals three vertical samples were done. Suspended load measurements were done with a modified depth integrating sampler. The mean value of suspended sediment load was found from single samples at 0.5 of the river depth and 0.54 of the canal depth. Sediment loads in flood stage could not be determined using conventional equipment and methods. The following techniques were used during these periods. Surface samples were collected from bridges, assuming that the turbulence around the piers would produce a homogeneous sample. A relationship was developed between average suspended sediment concentration and surface suspended sediment concentration, which was applicable to surface samples collected during floods. A relationship was determined between total (suspended and bed) load and average suspended load during stable conditions for calculation of total load at high flows. (See also W86-04843) (Cassar - PTT)
W86-04860

STUDY OF THE VARIABILITY OF SUSPENDED SEDIMENT MEASUREMENTS,
Agricultural Research Service, Chickasha, OK.
P. B. Allen, and D. V. Petersen.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 203-211, 3 fig, 4 tab, 6 ref.

Descriptors: *Sediment transport, *Suspended sediments, *Rivers, *Sampling, Washita basin, Oklahoma, Sediment load.

A study was made of the variability of suspended sediment concentration data collected using paired equal-transit-rate samples, paired vertical and equal-transit-rate samples, and paired automatic type and equal-transit-rate samples. Data were selected from two gaging locations in the U.S. southern plains. Equal-transit-rate sample concentrations collected by experienced operators. Agreement was less at the more difficult-to-sample location that had a large channel, a truss bridge, and a large sand load. The long-term sediment load for this location was computed with the higher of each of the paired concentrations obtained by less experienced operators. This load was 30% higher than the truer load derived with the lower concentrations. Data obtained with the single-vertical sampling method and automatic pumping-type samplers can be used to determine the entire suspended sediment load, if long-term sediment yield errors up to about 10% can be tolerated. (See also W86-04843) (Author's abstract)
W86-04863

ACCURACY OF ESTIMATING BASIN DENUDATION PROCESSES FROM SUSPENDED SEDIMENT MEASUREMENTS,
Institute of Meteorology and Water Management, Warsaw (Poland).
For primary bibliographic entry see Field 2J.
W86-04864

TECHNIQUES APPLIED IN DETERMINING SEDIMENT LOADS IN SOUTH AFRICAN RIVERS,
Pretoria Univ. (South Africa). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W86-04865

MEASUREMENT OF DEBRIS FLOW AND SEDIMENT-LADEN FLOW USING A CONVEYOR-BELT FLUME IN A LABORATORY,
Kyushu Univ., Fukuoka (Japan). Dept. of Civil Engineering.
M. Hirano, and M. Iwamoto.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 225-230, 12 fig, 2 ref.

Descriptors: *Sediment transport, *Flow measurement, *Suspended sediment, Flumes, Flow Rate.

Though a bore is a nonsteady flow, it can be treated as a steady flow in a coordinate system which moves at the same speed as the bore. To make a steady bore in the laboratory, a conveyor-belt type of flume with a movable bed was constructed. By setting the belt speed to that of the bore front, a statistic debris bore was obtained. In addition, flow of a zero mean velocity was obtained by setting the belt speed to that of the mean flow velocity for a selected slope. In this way detailed observations of grain behavior over long periods were possible with improved measurement accuracy. Experiments on debris flow and sediment-laden flow were undertaken incorporating measurements of grain concentration, velocity distribution and grain trajectories. (See also W86-04843) (Author's abstract)
W86-04866

SOME PROBLEMS RELATED TO SEDIMENT TRANSPORT MEASUREMENT IN STEEP MOUNTAIN STREAMS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
For primary bibliographic entry see Field 2J.
W86-04867

INTEGRATED DEBRIS FLOW OBSERVATIONS,
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
For primary bibliographic entry see Field 2J.
W86-04868

NEW METHODS OF MEASUREMENT OF SLOW PARTICULATE PROCESSES ON HILLSIDE SLOPES,
London School of Economics and Political Science (England). Dept. of Geography.
W. E. H. Culling.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 267-274, 1 fig, 17 ref.

Descriptors: *Sediment transport, *Soil mechanics, *Soil creep, *Slopes, Particulate matter, Mathematical studies.

Two methods for measuring soil creep on hillsides are proposed. The first relies on a steady-state solution to the diffusion equation for the region bounded internally by a circular cylinder. This method has some theoretical and practical difficulties, but it offers the advantage of a single, completely destructive observation that can be carried out in the laboratory. The second estimates the velocity of particles by counting. (See also W86-04843) (Cassar - PTT)
W86-04870

SEDIMENT MEASUREMENT IN THE YELLOW RIVER,
Yellow River Conservancy Commission, Zhengzhou (China).
For primary bibliographic entry see Field 2J.
W86-04871

MEASUREMENT OF SEDIMENT YIELD AND TRANSPORT IN MOUNTAIN TORRENTS IN JAPAN,
Public Works Research Inst., Tsukuba (Japan).
For primary bibliographic entry see Field 2J.
W86-04872

MEASUREMENT OF SUSPENDED SEDIMENT AND BED LOAD IN SAND BED CHANNELS AND THE ASSOCIATED PROBLEMS,
Illinois State Water Survey Div., Champaign.
For primary bibliographic entry see Field 2J.
W86-04873

SIGNIFICANCE, MEASUREMENT, AND ANALYSIS OF SEDIMENT DISCHARGES OF FLASHY STREAMS,
Irrigation and Power Research Station, Amritsar (India).
For primary bibliographic entry see Field 2J.
W86-04874

UPLAND EROSION: EVALUATION AND MEASUREMENT,
Istituto Sperimentale per lo Studio e la Difesa del Suolo, Florence (Italy).
For primary bibliographic entry see Field 2J.
W86-04877

INSTRUMENTATION FOR STUDIES OF THE EROSIVE POWER OF RAINFALL,
National Coll. of Agricultural Engineering, Silsoe (England).
N. W. Hudson.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 383-390, 1 fig, 31 ref.

Descriptors: *Erosion, *Measuring instruments, *Rainfall impact, Splash erosion, Soil erosion.

There is a need for both a worldwide study of the erosivity of rainfall, and also for detailed localized studies. Previous studies, which are reviewed, have used different techniques, and this complicates the comparison of results. The alternatives are (a) direct measurements of erosion, which are only effective for splash erosion; (b) computations from measurements of raindrop size, which is established but laborious technique even with modern scanners and signal analyzers; (c) direct measurement of rainfall properties such as impact stress, momentum, or energy. It is suggested that this last method is most appropriate because of developments in pressure transducers and microprocessors. The proposed route to standardization is first a comparative study of pressure transducers and acoustic or piezoelectric sensors, followed by development of an instrument suitable for cheap mass production, which could then be adopted and used by an international network. (See also W86-04843) (Author's abstract)
W86-04881

SOIL EROSION UNDER SIMULATED RAINFALL IN THE FIELD AND LABORATORY: VARIABILITY OF EROSION UNDER CONTROLLED CONDITIONS,
Scarborough Coll., Westhill (Ontario). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W86-04882

LABORATORY AND FIELD TESTING OF A PROGRAMMABLE PLOT-SIZED RAINFALL SIMULATOR,
Purdue Univ., Lafayette, IN. Agricultural Experiment Station.
For primary bibliographic entry see Field 2J.
W86-04883

OUTDOOR PORTABLE RAINFALL EROSION LABORATORY,
Agricultural Research Service, Morris, MN. North Central Soil Conservation Research Center.
C. A. Onstad, J. K. Radke, and R. A. Young.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 415-422, 6 fig, 8 ref.

Descriptors: *Erosion, *Measuring instruments, *Rainfall simulators, Simulated rainfall, Infiltration, Sediment concentration, Runoff, Soil surfaces, Microrelief profilimeter.

A trailer-mounted rainfall simulator for infiltration and erosion research has been built and tested. Rainfall is applied continuously through a series of drop forming needles. The simulator allows for a wide range of intensities, from near zero to approximately 200 mm/hour. In conjunction with the simulator, an automatic microrelief profilimeter is used to measure soil surface characteristics. This instrument automatically scans points on a 1 cm by 5 cm grid spacing to measure soil surface elevations with a vertical resolution of 1 mm over a 25 cm range. Also, associated with the laboratory is a density measuring apparatus which continuously records sediment concentrations in runoff water. (See also W86-04843) (Author's abstract)
W86-04884

PORTABLE RILL METER FOR FIELD MEASUREMENT OF SOIL LOSS,
Agricultural Research Service, Pullman, WA.
D. K. McCool, M. G. Dossett, and S. J. Yecha.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 479-484, 1 fig, 1 tab, 3 ref.

Descriptors: *Erosion, *Measuring instruments, *Soil loss, Soil erosion, Rill erosion, Rill meters, Runoff, Runoff plot.

A portable rill meter for measuring soil erosion is described. It has a working width of 1.829 m, uses long stainless steel pins, and has a maximum depth range of 410 mm. A 35 mm single lens reflex camera with a 28 mm wide-angle lens is used to record data. A grid background serves as reference or as a means for digitization. These instruments can be used after events in relatively inaccessible locations such as high elevation surface mine spoil banks and revegetated sites in remote areas. They can measure erosion on rangeland trails carrying heavy off road recreational vehicle traffic, on cropland to supplement runoff plot data, and on runoff collection plots to quantify rill and inter-rill erosion. The lightweight second version of the meter weighs 25 kg without the camera. (See also W86-04843) (Cassar-PTT)
W86-04890

FIELD MEASUREMENTS OF RATES OF BANK EROSION AND BANK MATERIAL STRENGTH,
Akademiya Nauk SSSR, Moscow. Soviet Geophysical Committee.
C. R. Thorne.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 503-512, 2 fig, 17 ref.

Descriptors: *Erosion, *Soil mechanics, *Field measurements, Stream banks, River banks, Soil properties, Shear strength, Tensile strength, Remote sensing, Sonar, Flumes, Aerial photography, Photograph, Maps.

Methods of monitoring rates and locations of bank erosion are reviewed. On-site measurements require a detailed map of the channel and bank lines. This can be done by plane tabling or the compass and tape technique. Spatial and temporal variations are obtained using erosion pins. On large rivers side-scan sonar can locate bank failures underwater. Remote sensing techniques involve aerial photography and historical maps. Measurements of bank material strength involve erodibility (studied in flumes), shear strength (measured with the borehole shear tester), and tensile strength (measured by the modified compression tester). (See also W86-04843) (Cassar - PTT)
W86-04893

LAND EROSION, RESEARCH EQUIPMENT, FORECASTING METHODS AND PROSPECTS FOR THEIR IMPROVEMENT,
Gruzinskii Nauchno-Issledovatel'skii Inst. Gidrotekhniki i Melioratsii, Tiflis (USSR).
For primary bibliographic entry see Field 2J.
W86-04895

TRACKING SALTY SOIL, SAVING FRESH WATER,
For primary bibliographic entry see Field 3C.
W86-04982

MONITORING WELL SCREEN INFLUENCES ON DIRECT FLOWMETER MEASUREMENTS,
K-V Associates, Inc., Falmouth, MA.
W. B. Kerfoot, and V. A. Massard.
Ground Water Monitoring Review, Vol. 5, No. 4, p 74-77, Fall 1985. 4 fig, 3 tab, 3 ref.

Descriptors: *Instrumentation, *Flowmeters, *Flow measurement, *Well screens, *Monitoring, *Groundwater movement, *Test wells, Directional determinations, Flow resistance.

A simple procedure is described to test an unknown well screen to determine its influence on measurement of direction and rate of groundwater flow. The investigations concern well screens constructed of smooth-interior, slotted or wrapped polyvinylchloride monitoring wells compatible with ground water flowmeters employing gravity bead packers where glass beads are used in a netbag to maintain porous flow conditions between the screened area and are used to transmit the heat pulse. A variety of commercial smooth-interior slotted and wrapped well screens were found satisfactory for sensitive measurements. Increasing the frequency of slots and the number of slot rows allows accuracies of directional determination of + or - 4 degrees. Using external packing material to keep silt out and maintaining a 0.02-inch slot width allows more than a six-fold increase in sensitivity to flow by lessening resistance to flow. The simple procedure employed for testing resistance to flow and accuracy of direction can be used on any unknown well screen to verify its suitability for measurements. (Rochester-PTT)
W86-05026

TWO-WAVELENGTH (0.86 CM AND 3.2 CM) RADAR OBSERVATION OF MICROPHYSICAL PROCESS IN STRATIFORM PRECIPITATION PART I. ATTENUATION OF RADAR WAVE DUE TO PRECIPITATION PARTICLES AND CORRECTION METHOD,
Nagoya Univ. (Japan). Water Research Inst.
For primary bibliographic entry see Field 2B.
W86-05091

TWO-WAVELENGTH (0.86 CM AND 3.2 CM) RADAR OBSERVATION OF MICROPHYSICAL PROCESS IN STRATIFORM PRECIPITATION PART II. STUDY ON SIZE DISTRIBUTION CHANGE OF PRECIPITATION PARTICLES,
Nagoya Univ. (Japan). Water Research Inst.
For primary bibliographic entry see Field 2B.
W86-05092

ACHIEVING IMPROVED FREQUENCY RESPONSE OF THE RAIN STRUCTURE FROM SPACEBORNE RADAR ALTIMETERS BY EMPLOYING DECONVOLUTION METHODS,
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
For primary bibliographic entry see Field 2B.
W86-05098

ACCURACY OF RAINFALL ESTIMATES BY RADAR, PART II: COMPARISON WITH RAIN-GAUGE NETWORK,
British Meteorological Office, Easthampstead (England). Operational Instrumentation Branch.
For primary bibliographic entry see Field 2B.
W86-05110

ACCURACY IN RAINFALL ESTIMATES BY RADAR, PART III: APPLICATION FOR SHORT-TERM FLOOD FORECASTING,
British Meteorological Office, Easthampstead (England). Operational Instrumentation Branch.
For primary bibliographic entry see Field 2B.
W86-05111

COMPATIBILITY OF CARBON UPTAKE RATES CALCULATED FROM STABLE AND RADIOACTIVE ISOTOPE DATA: IMPLICATIONS FOR THE DESIGN OF EXPERIMENTAL PROTOCOLS IN AQUATIC PRIMARY PRODUCTIVITY,
Centre de Recherche en Ecologie Marine et Aquaculture, Nieul sur Mer (France).
For primary bibliographic entry see Field 2H.
W86-05174

DIFFERENTIAL BARE FIELD DRAINAGE PROPERTIES FROM AIRBORNE MICROWAVE OBSERVATIONS,
Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
For primary bibliographic entry see Field 2G.
W86-05245

SOIL WATER EXTRACTOR THAT MINIMIZES CO2 DEGASSING AND PH ERRORS,
For primary bibliographic entry see Field 2G.
W86-05246

DISTRICT METERING,
Sunderland and South Shields Water Co. (England).
R. A. Pepper.
Journal of the Institute of Water Engineers and Scientists, Vol. 39, No. 6, p 485-493, December 1985. 1 fig, 3 tab, 5 ref.

Descriptors: *Water metering, *Telemetry, *Networks, *Data collections, Water use, Water districts, Computers, Monitoring, Water distribution, Leakage.

The Mid Kent Water Company of England started a telemetry system in 1968 which has evolved into a regular weekly, computer-assisted procedure for water accounting in some 240 districts covering much of the area of supply. The network also uses manually read meters with the potential to improve the metering level in the future. The metering system identifies districts with abnormal demands, assists in planning, optimizing and extending the distribution system and is a valuable aid in leak detection. The company maintains a strong uniformed prevention of waste department that handles both waste prevention and bylaw enforcement. Weaknesses in the current computational procedures are being examined along with domestic consumption levels, new metering equipment and a replacement computer-based telemetry system. (Geiger-PTT)
W86-05316

EFFECTIVENESS OF SAMPLING STRATEGIES FOR INTERTIDAL MONITORING,
Victoria Univ. of Manchester (England). Dept. of Zoology.
S. J. Hawkins, R. G. Hartnoll, G. A. Williams, P. J. Azzopardi, and M. T. Burrows.
Water Science and Technology WSTED4, Vol. 18, Nos. 4/5, p 63-72, 1986. 5 fig, 2 tab, 21 ref.

Descriptors: *Water sampling, *Intertidal areas, *Monitoring, Water quality control, Evaluation, Estuaries, Wales, Isle of Man, Statistical analysis.

Multiple random quadrats (25 cm by 25 cm) were sampled at five sites on depositing shores in South Wales and the Isle of Man. The effect of the increased number of samples was examined in relation to the reliability of estimation of various ecological measures (number of species, total individuals, total individuals of selected species). The replication required varies with the measure involved, but generally 10-20, or even more quadrats, are needed for reliable information which can be used to detect other than very gross changes with time. In monitoring programs, it is therefore advantageous to concentrate sampling efforts on a limited number of sites with high replication, because of this considerable spatial variation. The need to define specific aims, and to design a sampling format related to these aims, is emphasized. (Lantz-PTT)
W86-05358

7C. Evaluation, Processing and Publication

AUTOMATION OF DAILY WATER DISCHARGE COMPUTATION FOR RIVERS WITH DIFFERENT REGIMES,
Sredneaziatskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Inst., Tashkent (USSR).
Y. N. Ivanov.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 345-352, 19 ref.

Descriptors: *Discharge measurement, *Automation, *Rivers, *Computers, *Runoff, Flow discharge, Mathematical studies, Algorithms, Hydrologic data collections, Flood forecasting, Ice jams, Mathematical models, Data processing, USSR.

A system for processing hydrological data is proposed which allows one to automate the process of getting computerized daily water discharges, daily water stages, tables of measured water discharges and icing conditions of a water body. The system of processing consists of an automated input of initial information and its processing, the evaluation of quantity and accuracy of water discharge, and computation of parameters of water discharge curves. The selection of a method for computation of daily water discharges is made automatically by means of criteria elaborated by the author. Computation of discharge for the periods of out-of-bank flow, and during freeze-up, is realized by the methods accepted in the USSR; and for periods of river bed deformations by the method of time curves and Bolster, but with the author's corrections. Results are available in the form of tables of daily data with accuracy estimates of all the computations. The system is now under trial. (See also W86-04785) (Author's abstract)
W86-04814

RELIABILITY OF SUSPENDED SEDIMENT LOAD DATA,
Exeter Univ. (England). Dept. of Geography.
D. E. Walling, and B. W. Webb.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 177-194, 6 fig, 9 tab, 23 ref.

Descriptors: *Sediment transport, *Suspended sediment, *Sampling, Creedy River, United Kingdom, Sediment load, Mathematical studies.

Numerical indirect methods for estimating long-term suspended loads were applied to data from the River Creedy, United Kingdom, for which 7 years of continuous records were available. Serious over- and underestimation of loads was evident. Ratios of estimated/measured load for eight year-long periods and five interpolation procedures ranged from 0.17 to 3.13. (See also W86-04843) (Cassar - PTT)
W86-04861

ACCURACY AND PRECISION OF SUSPENDED SEDIMENT LOADS,
Guelph Univ. (Ontario). School of Engineering.
W. T. Dickinson.
IN: Erosion and Sediment Tranport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 195-202, 3 fig, 15 ref.

Descriptors: *Sediment transport, *Sampling, *Suspended sediment, *Rivers, Sediment load, Mathematical studies.

The effects of five computational methodologies and four sampling frequencies on the accuracy and precision of annual suspended sediment load estimates has been explored. The mean ratio of the estimated annual suspended load to the population suspended sediment load has been determined for each method and frequency as an index of accuracy. The standard deviation of the ratio has been

determined as an index of precision. Some computational methods have been found to be both precise and accurate over a range of sampling frequencies. One method appears to be reasonably precise but very inaccurate: another reasonably accurate but not precise. The results are seen to be extremely important for the selection of both sampling schemes and computational techniques for suspended sediment studies and for the evaluation of existing data sets. (See also W86-04843) (Author's abstract)
W86-04862

NATIONAL EROSION INVENTORY OF THE SOIL CONSERVATION SERVICE, US DEPARTMENT OF AGRICULTURE, 1977-1979,
Soil Conservation Service, Washington, DC.
J. N. Holeman.
IN: Erosion and Sediment Transport Measurement: Symposium, IAHS Publication No. 133, 1981. Proceedings of the Florence Symposium, June 22-26, 1981. p 315-319, 1 tab.

Descriptors: *Erosion, *Soil loss, Cropland, Range, Forests, Bank erosion, Pastures, Construction, Roads, Stream banks, Gully erosion, Erosion rates.

The Soil Conservation Service has completed the second phase of a national erosion inventory. Phase I covers erosion rates on cropland, range, forest, and pasture. Phase II covers erosion rates on stream banks, gullies, roads, and construction areas. Data collection was completed on October 1979 from 72,500 randomly selected sites on nonfederal land in all states except Alaska and including Puerto Rico. Total national erosion on nonfederal land is estimated at about 4.8 trillion mg annually, itemized as follows: cropland, 37.6%; range, 26.5% forest, 8.3%; pasture, 6.6%; stream bank, 10.6%; gullies, 5.7%; roads, 3.2%; and construction, 1.5%. Expressed at 1000 mg per year, the erosion losses for 610 million ha of nonfederal land are cropland, 1,786,676; pasture, 314,192; range, 1,263,218; forest, 396,875; stream banks, 501,763; gullies, 270,619; roads, 153,003; and construction, 72,529. Erosion data are also presented for streams, gullies, roads, and construction for each state. (See also W86-004843) (Cassar - PTT)
W86-04875

DATABASE MANAGEMENT,
Data Stream Systems, Greenville, SC.
L. G. Blackwell, and V. W. Langworthy.
Water Engineering and Management, Vol. 133, No. 3, p 23, March 1986.

Descriptors: *Database management, *Software, *Data collections, Management planning, Utilities.

Database management software for water and wastewater utilities is discussed in terms of selecting the software, software capabilities, using the data, and limitations of the software. Selection of database management software should be based on a careful assessment of each utility's needs. Important applications of data stored in the computer database files are generation of table (row and column) reports and a label format, which can be used for printing labels, addressing envelopes, and personalizing computer-generated correspondence. The user should distinguish between simple database software and more complex database management information systems. Finally, the prospective purchaser of computer hardware must know that the equipment to be purchased is compatible with the software to be used. (Rochester-PTT)
W86-05010

RAINFALL INVESTIGATIONS AT CARDINGTON AND WINCHCOMBE 1954-67,
British Meteorological Office, Bracknell (England).
For primary bibliographic entry see Field 2B.
W86-05045

NEW TECHNIQUE FOR MONITORING THE WATER VAPOR IN THE ATMOSPHERE,
Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
For primary bibliographic entry see Field 2B.
W86-05097

ACCURACY OF RAINFALL ESTIMATES BY RADAR, PART I: CALIBRATION BY TELEMETERING RAINGAUGES,
British Meteorological Office, Easthampstead (England). Operational Instrumentation Branch.
For primary bibliographic entry see Field 2B.
W86-05109

ACCURACY IN RAINFALL ESTIMATES BY RADAR, PART III: APPLICATION FOR SHORT-TERM FLOOD FORECASTING,
British Meteorological Office, Easthampstead (England). Operational Instrumentation Branch.
For primary bibliographic entry see Field 2B.
W86-05111

DETERMINATION OF SATURATED HYDRAULIC CONDUCTIVITY FROM SOIL PERCOLATION TEST RESULTS,
Oxford Univ. (England).
For primary bibliographic entry see Field 2G.
W86-05124

ANALYSIS OF GROUNDWATER QUALITY DATA OBTAINED FROM PRIVATE INDIVIDUAL WATER SYSTEMS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park. School of Forest Resources.
For primary bibliographic entry see Field 2F.
W86-05140

8. ENGINEERING WORKS

8A. Structures

HEAVY RAINS HASTEN BRIDGE REPLACEMENT,
H. M. Barr.
Public Works, Vol. 117, No. 5, p 56-57, May 1986.

Descriptors: *Bridge construction, *Bridge design, Precipitation, Soil properties, Flood plains, Linings, Concrete, Texas, Longview.

On March 20, 1985, a particularly heavy rain caused the supporting timbers under the King Street Bridge, Longview, TX to begin to fracture, forcing city officials to close the crossing to traffic. Within Longview is the 1,900 acre drainage basin of Wade Creek, which along its 3.6 mile course is crossed at mile 1.7 by the King Street Bridge. The major design considerations were the 100 year discharge of Wade Creek at King Street, the elevations of intersecting streets and driveways, and the soil condition. The 100 year discharge of the basin was 2,850 cfs and the flood plain elevation was approximately 2 ft above the old wooden structure. The creek was concrete lined for 30 ft on each side of the bridge. Wicks extending from the top of the ditch wall lead to weep holes near the bottom. The new bridge opened to traffic three and a half months after closure of its predecessor. The combination of precast concrete boxes, filter fabric, crushed rock base, and drainage wicks were used to provide the city an efficient design, timely construction, and a project with potential for a long life. (Peters-PTT)
W86-04683

IMPLEMENTING THE TALIHA MINI HYDRO SCHEME IN ZAIRE,
M. Gebendinger.
Water Power and Dam Construction, Vol. 38, No. 2, p 35-36, April 1986.

Descriptors: *Zaire, *Kyondo, *Taliha mini hydro, *Construction, Hydroelectric plants, Developing countries.

Planning and construction of a small hydroelectric plant at Kyondo, Zaire, were carried out by volunteer engineers and missionaries in cooperation with local villagers. Simplicity of operation, with many hand-operated features, characterized the design. Much of the construction of roadways, headrace, and powerhouse materials was done by local labor with a minimum of modern construction equipment. To date, the peak load has never exceeded 60 kW, equal to no more than 20% of the maximum rated load, but the plant has run practically 100% of the time over the last four years. The only shutdown occurred when the headrace was nearly filled with storm debris, and the locally trained operators managed the problem. (Rochester-PTT)
W86-04726

SALVAGING A WATER RESERVOIR,
Overman (W.C.) Associates, Virginia Beach, VA.
R. L. W. Kelly, W. M. Boone, and J. R. Spacek.
Public Works, Vol. 117, No. 4, p 50-51, April 1986.

Descriptors: *Storage reservoirs, *Rehabilitation, *Reservoir construction, Post-tensioned concrete, *Thoroseal, *Cost analysis, *Portsmouth, *Virginia, Leakage, Structural deterioration, Concrete spalls.

Portsmouth, Virginia's Godwin southern reservoir, a 2 million gallon facility built in 1920, but was suffering loss of capacity due to leakage and had severe structural deterioration. Rehabilitation was chosen as a much less expensive alternative to construction of a new reservoir. Under the plan, the concrete walls and floor slab would be salvaged, and the expansion joints repaired, but top slabs would be replaced. Replacement of the top slab was accomplished using a post-tensioned slab system at a cost of 305,334 dollars, and numerous spalls in the concrete walls were repaired. All concrete surfaces were treated w'h Thoroseal, and the earth berm around the reservoir was reseeded. Construction of a new reservoir had been estimated to cost more than 900,000 dollars. (Rochester-PTT)
W86-04739

BIG BUCKS SAVED ON SEWER REHABILITATION PROJECT,
D. R. Lovejoy, and K. J. Munz.
Public Works, Vol. 117, No. 4, p 53-54, April 1986.

Descriptors: *Sewers, *Maintenance, Bogs, Long Island, New York, Pipes, Maintenance costs, Acidic soils.

The sewer system of Freeport, Long Island, New York, was built in 1927 and included concrete pipes and asbestos cement, all of which have become leaky from the effects of acidic subterranean bogs through which they passed. Various rehabilitation alternatives were considered to correct the serious infiltration problems within the system. The Insituform process was chosen, in which a polyester felt sleeve saturated with thermosetting resins is inserted inside out into the sewer, and unrolled by the pressure from a column of water. Heat is then applied to set the resin. Two contracts for different aspects of this work totaled 6 million dollars, making it the largest Insituform installation in the United States. One half of the construction project was the lining procedure and the remainder was repair and replacement of pipes that were too badly deteriorating for lining. (Rochester-PTT)
W86-04740

DURABLE CHEMICAL GROUT SOLVES 'CASE OF THE DISAPPEARING LAKE',
R. H. Allred, and B. W. Kostyk.
Public Works, Vol. 117, No. 4, p 68-69, April 1986.

Descriptors: *Sewer infiltration, *Acrylamide grout, *Scout-seal grout, *Sinkholes, *Auburndale, *Florida, Maintenance, Roads, Water table.

Severe infiltration problems existed in Auburndale, Florida, for many years because much of the sewage piping was laid below the water table. In one part of town the area lift station operated continuously and wet season flows exceeded 1.0 million gal/day, even though the theoretical flow based on the local population was only 0.25 million

gal/day. Attempts to seal the piping with acrylamide chemical grout failed twice. Ultimately Scotch-Seal 5600 (Foam grout, formerly known as 3M Brand CR 202 Grouting Compound) was tested and installed. Scotch-Seal 5610 Gel has been used more recently in other parts of the network. This grouting system is working well, preventing infiltration, the development of sinkholes in roads, and the drainage of Little Lake Dickey into the sewage network. (Rochester-PTT)
W86-04742

GLEN CANYON DAM'S QUICK FIX,
Water and Power Resources Service, Denver, CO.
M. S. Eckley, and D. L. Hinchliff.
Civil Engineering (ASCE), Vol. 56, No. 1, p 46-48, January 1986.

Descriptors: *Colorado River, *Arizona, *Glen Canyon Dam, *Maintenance, Spillway, Open channel, Concrete arch, Dams, Tunnels, Seepage control.

When the spring runoff rampaged down the Colorado River in 1983, Glen Canyon Dam was one of its victims. The Bureau of Reclamation had only 10 months to make repairs in time for the following spring's flows. The Guy F. Atkinson Construction Company was hired on a cost reimbursable basis. Both the designer and contractor began work immediately. Neither limited access to the remote Northeastern Arizona site, water seepage, nor a confined work area kept them from meeting their deadline. Close monitoring of work progress and efficient use of resources helped. Located on the Colorado River, 15 miles upstream of Lee's Ferry, Arizona, the 710 foot high concrete arch dam has an open-channel flow-type spillway in each abutment. Each spillway consists of a 41 foot diameter concrete lined section inclined at 55 degrees, a vertical bend, some 1000 feet of near horizontal tunnel and a flip bucket at the downstream tunnel portal. Construction was speeded up by the use of multiples of specialized equipment, and by the building of a concrete plant on-site. Two 20 ft. diameter tunnels were driven through the sandstone canyon walls to repair horizontal portions of the tunnel spillway. This work was accomplished in 3 wk using a roadheader continuous mining machine. Water seepage in the tunnels was controlled by a dewatering platform at the spillway intake, French drains and ditches, and water barriers and plastic sheeting. (Peters-PTT)
W86-04957

LIFT STATION DESIGN,
GRW Engineers, Lexington, KY.
B. Montgomery.
Civil Engineering (ASCE), Vol. 56, No. 1, p 66, January 1986.

Descriptors: *Sanitary wastewater, *Computer programs, *Storm wastewater, *Wastewater treatment, Pumping, Least squares method.

A computer program was written to run on an IBM PCXT or AT and other IBM-compatible machines to aid in the design of duplex sanitary or storm sewage lift stations. The program assumes a duplex station, with the second pump used solely for backup. There are no provisions for multiple pump operation. The system head curve is calculated using the least squares method of curve-fitting through three points. The calculation of a pump curve requires the user to select one or more pump curves from a manufacturer's catalog that will produce the desired operating conditions. The system head curve and the pump curve are intersected to produce a preliminary operating point for the selected pump. Input for wet well design includes type of wet well, wet well dimensions, the invert elevation of the lowest line entering the wet well, and the minimum wastewater depth in the wet well. The program assigns a new low level wastewater surface elevation in the wet well, and then recalculates the system head curve and final operating point. The program can then create a printout that provides backup documentation for a design file, or is suitable for inclusion in reports. (Peters-PTT)
W86-04959

CONTROL OF SPILLWAY GATES DURING FLOODS,
Lewin Fryer and Partners, Richmond (England).
J. Lewin.
Water Services, Vol. 90, No. 1081, p 93-95, 98, March 1986. 7 fig.

Descriptors: *Spillway gates, *Floods, *Dams, Safety, Computer control, Automatic gates, Transmission lines, Gates, Reservoirs, Automation.

Methods of controlling spillway gates during floods are reviewed. The objectives of spillway gate operation include the safety of the dam (ensured by preventing the reservoir level from rising to within a few meters of the crest, maximum storage, flood routing, and bank stability. The operating rules and systems are presented for both manual methods, (local control of motorized operation, remote control of motorized operation, and computer assisted control) and automatic methods. Cascade control is generally used in conjunction with power actuation of gates, either by electric motor driven winches or by oil hydraulic cylinders. Level control by electro-mechanical control is actuated by a predetermined rise in the reservoir level above the retention level, which initiates opening of the gates in steps and in sequence. Level control by computer (feedback) control system) moves the gate to a set point after determining the desired outflow with reference to the measured inflow. The water-level-operated automatic gates are either sector gates, drum gates, or radial automatic gates. A survey of existing practice shows wide variation between operators. In nearly all cases, at least one stage of redundancy is introduced for critical equipment and in many cases, two stages are provided. Transmission links are usually duplicated. In exceptional circumstances, dedicated buried transmission lines are used. The trend toward automatic control of spillway gates is likely to continue because it eliminates 24 hr manning and reduces the requirements for trained personnel. Regular, thorough maintenance and testing is essential to maintain reliability. (Peters-PTT)
W86-04993

SCALE MODEL TESTS FOR AUSTRIA'S KUHTAI PUMPED-STORAGE PLANT,
Technische Univ., Graz (Austria). Dept. of Hydromechanics, Hydraulics and Hydrology.
For primary bibliographic entry see Field 8C.
W86-04997

CONSTRUCTION OF SPAIN'S CORTES-LA MUELA SCHEME,
Hidroelectrica Espanola, Madrid.
For primary bibliographic entry see Field 8C.
W86-05000

CHINA'S FIRST WORLD BANK-ASSISTED HYDRO SCHEME,
Ministry of Water Resources and Electric Power, Beijing (China).
For primary bibliographic entry see Field 8C.
W86-05001

WORLD'S HIGHEST DAM CONQUERS HARSH ENVIRONMENT,
Vsesoyuznyi Gidroproektno-Izyskatel'skii i Nauchno-Issledovatel'skii Inst. 'Gidroproekt', Moscow (USSR).
For primary bibliographic entry see Field 8D.
W86-05002

TECHNIQUES FOR SOVIET PUMPED-STORAGE PLANT CONSTRUCTION,
Vsesoyuznyi Gidroproektno-Izyskatel'skii i Nauchno-Issledovatel'skii Inst. 'Gidroproekt', Moscow (USSR).
For primary bibliographic entry see Field 8C.
W86-05003

LARGE CONCRETE DAM CONSTRUCTION IN THE USSR,
Vsesoyuznyi Gidroproektno-Izyskatel'skii i Nauchno-Issledovatel'skii Inst. 'Gidroproekt', Moscow (USSR).
L. P. Mikhailov.
Water Power and Dam Construction, Vol. 38, No. 3, p 24-28, March 1986. 5 fig, 1 tab.

Descriptors: *Dam construction, *USSR, *Concrete, Arch dams, Concrete buttress dams, Concrete, Gravity dams, Model studies, Cranes, Geology, Seismology.

Characteristics of the major concrete dams in the USSR are summarized, and problems associated with their design and construction are discussed. Most of the large, high-head concrete dams in the USSR are concrete gravity dams, with some arch dams and concrete buttress dams. A uniform system of state standards and norms is employed for construction of dams in the USSR. In addition to stress and strain calculations, seismic analyses are conducted. Geomechanical models are frequently employed. Experience in the construction of dams in severe climate conditions in the USSR has resulted in progress on techniques to ensure reliability and efficiency in such areas as concrete placement, use of cranes in construction, and placement of concrete dams on rock foundations. Areas still needing investigation are application of concrete with low cement content, development of a continuous construction procedure, eliminating pipe cooling of concrete, and decreasing the amount of cement and reinforcing steel used in dams. (Rochester-PTT)
W86-05004

TIDAL POWER ENGINEERING IN THE USSR,
Vsesoyuznyi Gidroproektno-Izyskatel'skii i Nauchno-Issledovatel'skii Inst. 'Gidroproekt', Moscow (USSR).
L. Bernstein.
Water Power and Dam Construction, Vol. 38, No. 3, p 37-41, March 1986. 6 fig, 10 ref.

Descriptors: *Tidal powerplants, *Caissons, *USSR, *Bulb turbines, *Double-action generation, *Ecological impact, Hydraulic engineering, Feasibility studies, Tide cycles, Tide range, Peaking capacity.

Tidal power experience in the USSR and possible employment of tidal power to supply peak load in Western Europe are discussed. Experience with the 400 kW Kislaya Guba tidal powerplant is reviewed, and the characteristics of three proposed tidal power schemes are discussed as follows: Mezensk, with a tidal range of 9 m, a powerhouse with 800 x 19 MW bulb units built into a 92.9 km-long dam and including floating caissons housing generating sets with 10-m-diameter runners; Turgursk, where a total of 10 GW could be generated along with 35 km-long dam for a total annual output of 27 TWh and also using caissons for holding generating sets; and Pezhinsk, where two possible sites exist for a tidal powerplant of 87 GW capacity that could generate 200 TWh annually. The following main criteria were used in the feasibility studies of the three projects: double action (ebb and flow) arrangement and Rance type bulb turbine with the runner diameter increased to 10 m to comply with the design of the Leningrad Metal Works. The ebb and flow arrangement ensures a 25% increase in power output, and reduces the ecological impact of the project by almost completely retaining the original tide cycles and range. (Rochester-PTT)
W86-05005

UNDERGROUND WORKS AT KENYA'S KIAMBERE PROJECT,
Watermeyer, Legge, Piesold and Uhlmann, London (England).
R. D. Gill, and D. S. Lawrenson.
Water Power and Dam Construction, Vol. 38, No. 5, p 13-16, May 1986. 6 fig, 2 tab.

Descriptors: *Kenya, *Powerhouse, *Tunnels, *Pressure shafts,.*Surge chambers, *Underground powerplants, *Tunnel construction, Hydroelectric plants, Powerplants.

Three different approaches to underground work in rock of excellent quality with negligible water

infiltration are compared as found in the three separate civil works contracts for the 140 MW Kiambere project, Kenya. The three projects were for underground powerhouse and associated tunnels, pressure shafts, tailrace tunnels, and surge chambers; intake and headrace tunnel; and dams, spillway, and river diversion tunnels. Geology, site investigations, design of the power system, design of the diversion tunnels, construction of tunnels, construction of shafts, and powerhouse cavern are discussed. Tunneling and shaft sinking data are provided, including excavation procedures, support system, and concrete, for each of the three portions of the excavation works. (Rochester-PTT)
W86-05006

OPTIMUM CAPACITY AND TUNNEL DIAMETER OF RUN-OF-RIVER PLANTS,
Morrison-Knudsen Engineers, Inc., San Francisco, CA.
F. Fahlbusch.
Water Power and Dam Construction, Vol. 38, No. 5, p 17-20, May 1986. 5 fig, 2 ref.

Descriptors: *Hydroelectric plants, *Tunnel design, *Hydraulic design, Mathematical models, Optimization, Powerplants.

A solution is described of the problem of optimization of the capacity of run-of-river hydro plants with tunnels. The solution is a special case to the general two-variable optimization problem; it defines an upper boundary of the optimum capacity of these plants. In addition to providing the initial value for the iterative solution procedure, it also can be used to obtain a quick order-of-magnitude estimate of the plant capacity in cases where an approximate figure is sufficient. The solution presented here is exact and avoids the lengthy and time-consuming calculations involved in numerical calculations. In addition, it provides valuable insight into the interaction of some variables and their individual and cumulative effects, thus providing useful guidance in design. Only plants with single tunnels are considered and constraints that could narrow the choice of tunnel diameter are disregarded. The solution is obtained either by iteration or step-by-step evaluation of the optimality conditions. It is shown that if the relationship between capacity and tunnel diameter is not taken into account, the plant design may be substantially at variance with the optimum. (Rochester-PTT)
W86-05007

DESIGN OF PERVIOUS PRESSURE TUNNELS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
A. J. Schleiss.
Water Power and Dam Construction, Vol. 38, No. 5, p 21-26, May 1986. 13 fig, 1 tab, 32 ref.

Descriptors: *Tunnel design, *Rock properties, *Tunnel hydraulics, *Permeability, Hydraulic design, Seepage, Hydraulic engineering, Differential equations.

A new design procedure for pressure tunnels takes into account the seepage pressures and the influence of fracture deformation on secondary permeability in rock masses. The porous, thick-walled cylinder theory, computation of pervious tunnels, and mechanical-hydraulic coupling are analyzed, including the differential equation for radial displacement of the cylinder, deformations and stresses, influence of mechanical boundary loads, a pressure tunnel with uncracked concrete lining, reach of the seepage flow pattern, effect of cracks in lining and rock effect of rock grouting, influence of fracture deformation on secondary permeability, the thick-walled cylinder with stress-dependent permeability, and an pressure tunnel with stress-dependent permeability. Design criteria are discussed for avoiding cracks in the lining, limiting water losses, and ensuring the bearing capacity of the rock masses. (Rochester-PTT)
W86-05008

INFLUENCE OF AN ARTIFICIAL HYDRAULIC REGIME ON WATER QUALITY IN THE TIDAL RIVER LAGAN, NORTHERN IRELAND,
Department of Economic Development, Belfast (Northern Ireland). Industrial Science Div.
For primary bibliographic entry see Field 5G.
W86-05080

EFFECTS OF WATER INTERACTIONS ON ENGINEERING STRUCTURES,
Binnie and Partners, London (England).
For primary bibliographic entry see Field 8B.
W86-05276

8B. Hydraulics

HYDRAULICS OF TWO FLOWING LAYERS WITH DIFFERENT DENSITIES,
Scripps Institution of Oceanography, La Jolla, CA.
For primary bibliographic entry see Field 2E.
W86-04714

RIVER MECHANICS,
University of East Anglia, Norwich (England). School of Environmental Sciences.
For primary bibliographic entry see Field 2J.
W86-04750

MEASUREMENT OF OPEN CHANNEL FLOW BY THE ELECTROMAGNETIC GAUGE,
Department of the Environment, Reading (England). Water Data Unit.
For primary bibliographic entry see Field 7B.
W86-04804

ENTRAINMENT DESCRIPTIONS FOR MATHEMATICAL MODELING OF PUMPED-STORAGE INFLOWS IN RESERVOIRS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
P. J. W. Roberts, and M. S. Dortch.
Final Report. Technical Report E-85-12, October 1985. 118 p, 14 fig, 22 ref, 3 append. Contract Nos. DACW39-81-M-2771, DACW39-82-M-3273.

Descriptors: *Entrainment, *Mathematical models, *Pumped storage, *Reservoirs, *Inflows, Jets, Simulation models, Water quality.

During hydropower generation and pumpback operations of pumped-storage projects, inflows are introduced into the reservoir system. These jetlike inflows often cause considerable entrainment of ambient water. The entrainment process can have a strong influence on the vertical distribution of reservoir water quality when pumped-storage inflow jets are discharged into a stratified reservoir. The objective of this study was to develop algorithms to describe the pumped-storage inflow entrainment process for use in reservoir water quality models. Pumped-storage inflow jets fall into two classes: strongly or weakly buoyant. The former class has been fairly extensively studied, and well-established mathematical models exist to predict their behavior. For this case, incorporation into a reservoir thermal model simply required adaptation of existing code. For the latter case, however, that of weakly buoyant jets, it was found that little information existed of either a theoretical or experimental nature. For that reason, an extensive series of experiments of a fundamental nature were performed on weakly buoyant jets into arbitrary stratification. The results were then reduced to a form suitable for inclusion into reservoir water quality simulation models. The developed algorithms were incorporated into an existing reservoir thermal simulation code, and a test application was made for Carters Lake, a Corps of Engineers pumped-storage project in Georgia. (Author's abstract)
W86-04940

LABORATORY MODELING OF A COASTAL UPWELLING,
University of Southern California, Los Angeles. Dept. of Mechanical Engineering.
For primary bibliographic entry see Field 2L.
W86-04980

NATURAL FLOW VISUALIZATION IN LAKE EYRE, SOUTH AUSTRALIA,
Flinders Univ. of South Australia, Bedford Park. School of Earth Sciences.
For primary bibliographic entry see Field 2H.
W86-04981

WAVE INTERACTION WITH A RECTANGULAR TRENCH,
California Inst. of Tech., Pasadena. W.M. Keck Lab. of Hydraulics and Water Resources.
F. C. K. Ting, and F. R. Raichlen.
Journal of Waterway, Port, Coastal and Ocean Engineering (ASCE) JWPED5, Vol. 112, No. 3, p 454-460, May 1986. 1 tab, 6 fig, 4 ref.

Descriptors: *Waves, *Trenches, *Fluid mechanics, Kinetics, Channel improvement, Dredging.

An initial phase of an investigation of the wave-trench interaction in a constant density fluid revealed an apparent effect of the relative wavelength and the trench geometry on the reflection and transmission characteristics of the trench and on the kinetic energy of the fluid within the trench compared to that in the incident progressive wave. This frequency selectivity may be related to a resonant condition in the trench although the details of this are not clearly apparent. The velocities near the corners of the trench are intensified by the flow process. These results are of consequence in the process of aging of navigation channels due to waves and currents where channel dredging modifies the near bottom kinematics which can then affect the channel shape. (Peters-PTT)
W86-04987

ARMOR LAYER STABILITY OF RUBBLE-MOUND BREAKWATERS,
P. A. Hedar.
Journal of Waterway, Port, Coastal and Ocean Engineering, (ASCE)/JWPED5, Vol. 112, No. 3, p 343-350, May 1986. 5 fig, 8 ref, append.

Descriptors: *Breakwaters, *Mathematical models, *Stability analysis, Rubble-mound, Wave height, Permeability, Angle of repose, Slope stability, Rocks.

Improved stability formulas for rubble-mound breakwaters calculate the required weight of the armor units in the cover layer reflect the complex phenomena, and take into account the most important parameters affecting the stability. The influence of the wave climate, the difference between the angle of repose and the slope angle, the density of the block material and the fluid, and the permeability of the underlayers are involved. The weight of the armor units under no-damage conditions is determined. The difference in the weight Q of armor units calculated from the given equation, which consider permeability of underlayers and interlocking is considerable compared with those calculated using existing equations. The block weight Q will get larger as the breaking wave height increases with increasing wave period. The required block weight under no-damage conditions varies to a high degree and to an extent that does not appear when using a previously developed formula. The most suitable gradient of the slope for the armor layer is from 1 on 2 to 1 on 3. (Peters-PTT)
W86-04988

EFFECTS OF WATER INTERACTIONS ON ENGINEERING STRUCTURES,
Binnie and Partners, London (England).
A. N. James, and K. J. Edworthy.
Hydrological Sciences, Vol. 30, No. 3, p 395-406, September, 1985. 5 fig, 25 ref.

Descriptors: *Structural engineering, *Earth-water interfaces, Dissolution, Rocks, Water analysis, Groundwater movement, Erosion.

The interactions of water with soil and rock are important to many engineering structures built to contain or transport water. These structures, built on soluble rock or soil foundations, may depend on rates of dissolution caused by water seeping through joints, fissures, or granular zones. Previous papers have defined the rates of dissolution for soluble rocks by means of a simple equation: dM/dt = K A (Cs - C) to the theta power. This relationship may be used as an aid to prediction of enlargement of joints and fissures in rocks, settlements of granular foundation strata, the deterioration of filters, risks to shallow but intensely loaded foundations, and durability of underground storage caverns in soluble rocks. Predicting the effects of dissolution of soluble rocks or soils depends, sometimes critically, upon the solution potential of the water reaching the soluble materials. Particularly at the planning stage, but also in the specification of remedial measures, consultation with hydrologists is advisable to achieve a full understanding of the groundwater flow and chemistry and of the surface/groundwater interconnections. (Main-PTT)
W86-05276

UNCONFINED GROUNDWATER FLOW CALCULATION INTO A TUNNEL,
Tahal Consulting Engineers Ltd., Tel-Aviv (Israel). Hydrology Div.
For primary bibliographic entry see Field 2F.
W86-05298

MORPHOLOGIC EFFECTS OF CHANNELIZATION: THE CASE OF THE NEEBING-MCINTYRE FLOODWAY, THUNDER BAY, ONTARIO, CANADA,
Lakehead Univ., Thunder Bay (Ontario). Dept. of Geography.
H. Rasid, B. A. M. Phillips, and M. Oosterveld.
Environmental Management, Vol. 9, No. 5, p 399-416, September, 1985. 12 fig, 6 tab, 30 ref.

Descriptors: *Channel morphology, *Neebing-McIntyre Floodway, *Floodways, Erosion, Sediment yield, Hydraulic geometry, Backwater effect, Maintenance, Canada, Energy gradient, Sediment transport.

A study was conducted to compare the post construction morphology of a channelization project with the preconstruction morphology of the channelized streams and to postulate the most immediate morphological effects of such channelization. The Neebing-McInyre floodway, in Thunder Bay, Ontario, Canada, was constructed with a relatively straight and uniform trapezoidal channel, compared with the prechannelized sinuous reaches of the Neebing and the McIntyre Rivers. The flow regime of the floodway also contrasts significantly with the prechannelized regime, because of the combination of discharges from these rivers into a new channel and the regulation of flows by a diversion structure. The maximum channel capacity of the floodway is 284 cu m/s (175-year regional flood), compared with about 40 cu m/s and 60 cu m/s, respectively, for the Neebing and McIntyre. According to regime theories, the construction of a straight and trapezoidal channel has upset the equilibrium of the stream system and therefore should lead to some accelerated erosion and sedimentation processes in the new channel immediately after construction. Erosion potential is particularly high during higher discharge events. The overall sediment yield of the watersheds of North America, but due to the backwater effect of Lake Superior. Unless maintained by constant channel work, the floodway will tend to fill up with sediment, until a postconstructional equilibrium is reestabliahed. (Peters-PTT)
W86-05408

8C. Hydraulic Machinery

INNOVATIVE DESIGN OVERCOMES MULTIPLE INSTITUTIONAL BARRIERS AT HYDRO PLANT,
J. Reason.
Power, Vol. 130, No. 4, p 120-122, April 1986. 8 fig.

Descriptors: *Powerplants, *Electric power plants, Massachusetts, Lowell, Merrimack River, Fish ladders, Gravity dams, Tourism, Hydraulic turbines, *Institutional constraints, Recreation facilities.

When a new 15 MW low head hydroelectric project was first proposed in the center of Lowell, MA, the Department of Energy gave it a 20 percent chance of ever being completed because of institutional barriers. The major problems were the protection of Lowell's many historic structures along its canal system and the protection of fish in the Merrimack River. Despite these hurdles, the project was completed one month ahead of schedule and is now generating revenue for its owner, Boott Hydropower Inc. The powerhouse was designed with a low profile, set into the riverbank in an 80 ft deep excavation. The Northern Canal runs from the Pawtucket Dam 2200 ft along the side of the river before turning inland to divert water into the forebay. A small lock, built at the right-hand end of this dam permits Park Service tour boats to navigate the entire canal. At the Pawtucket dam a new fish ladder was built with lampblack-darkened concrete to blend in with the weathered stone. At the powerhouse, migrating fish are collected in an elevator, raised to a window where a Fish and Wildlife Service biologist counts them, and passed either into the canal or back to the river. The 13 foot diameter direct driven hydraulic turbines turn at 120 rpm. (Peters-PTT)
W86-04682

POWER FROM MINE COOLING WATER,
Foster-Miller, Inc., Waltham, MA.
R. N. Torbin, and E. Thimons.
Power Engineering, Vol. 90, No. 3, p 27-28, March 1986. 3 fig, 1 tab, 1 ref.

Descriptors: *Turbines, *Generators, *Energy conservation, *Hydroelectric plants, *Mines, Idaho, Cost analysis, Performance evaluation, Cooling water.

Results of a demonstration project are described in which a turbine-generator system was installed in the Lucky Friday deep mine, Mullan, Idaho, and used to recover potential energy of cooling water flow, thereby increasing efficiency of the refrigeration system as well as generating electrical power at a considerable saving. The turbine-generator employed could produce 210 kW of power at an average flow of 31.5 liter/sec with an inlet head of 840 m. In three performance tests, head and flow data were identical to predicted values, indicating that the difference between actual and predicted performance of the system was caused by lower than expected efficiency of the turbine, generator, or electrical system. However, the actual system efficiences were deemed acceptable. By the end of August 1985, the system had run 10 months without any major problems and had produced more than 1,000,000 kWh of power. This resulted in a gross savings of approximately 25,000 dollars. (Rochester-PTT)
W86-04703

SMALL HYDRO CASCADE DEVELOPMENTS IN CHINA,
Hangzhou Regional Center For Small Hydropower (China).
D. Guangquan.
Water Power and Dam Construction, Vol. 38, No. 2, p 16-20, April 1986. 6 fig.

Descriptors: *Run-of-river, *China, *Cascade hydroelectric systems, *Flow regulation, *Electric power demand, Hydroelectric power, Economics, Developing countries.

Because of seasonal variation in stream flow and daily fluctuations of load, it is difficult to balance the supply and consumption of electric power with run-of-river small hydro power (SHP) stations in China. Cascade developments involving a number of stations can help solve these problems. Planning and operation of cascade SHP developments are described including the characteristics of five differently-configured cascade schemes in China and a summary of the characteristics of the cascade schemes on the He Jiang River tributaries. Cascade developments, where one or several reservoirs regulate stream flow can make full use of both the head of the river and the regulated flow, and hence can balance supply and demand of electricity in small grids. Many SHP-developed counties in China have proceeded with cascade developments on small streams. These stations have become the backbone of the county grids, greatly improving the reliability of electricity supply and providing significant economic benefits. (Rochester-PTT)
W86-04723

ECONOMIC LIMITS OF SMALL AND LOW-HEAD HYDRO,
Monenco Consultants Ltd., Montreal (Quebec).
For primary bibliographic entry see Field 6B.
W86-04724

STANDARD DESIGN FOR SIX MINI HYDRO SITES IN INDONESIA,
Beca Worley International, Auckland (New Zealand).
P. S. Crighton, G. L. Barker, and J. M. Magyari.
Water Power and Dam Construction, Vol. 38, No. 2, p 26-30, April 1986. 7 fig, 4 tab.

Descriptors: *Design standarization, *Indonesia, *Run-of-River hydro, *Hydroelectric power, *Cost analysis, Francis turbine, North Sumatera, Hydroelectric engineering, Developing countries.

A rational approach is presented for the development of mini hydro sites using one design for multiple sites. Small sacrifices in efficiency resulting from this approach are compensated by savings in development costs, an important consideration for developing countries. This technique has been applied successfully to a project to develop six mini hydro sites in North Sumatera, Indonesia. Standard designs were prepared for the following components and fitted to each site plan: weir and river bypass culvert, diversion intake, de-sand channel, canal, penstock intake and penstock, powerhouse, generating equipment, switchgear, protection and control, and gates. A horizontal Francis turbine was selected. The total installed capacity at the six run-of-river sites was 6,000 kW; the total development cost was 12.66 million US dollars, with a per kilowatt average cost of 2,110 dollars. (Rochester-PTT)
W86-04725

IMPLEMENTING THE TALIHA MINI HYDRO SCHEME IN ZAIRE,
For primary bibliographic entry see Field 8A.
W86-04726

JONES FORK SMALL HYDRO SCHEME,
Tudor Engineering Co., San Francisco, CA.
G. Rummel, and R. Everett.
Water Power and Dam Construction, Vol. 38, No. 2, p 54-57, April 1986.

Descriptors: *Small hydro, *Jones fork, *California, *Pressure regulator valve, *Surge tank, Penstock, Tunnels, Intakes, Seismicity, Design, Planning, Environmental studies, Intakes, Hydraulic equipment, Upper American river project, Sacramento Municipal Utility District, Cost analysis.

The Jones Fork hydroelectric project of Sacramento (California) Municipality Utility District includes development, planning, preliminary design, licenses, permits, and environmental studies, exploration and survey, seimicity, intake structure, power tunnel, penstock, and powerhouse and equipment. This portion of the Upper American river project is a 182.9 m head hydroelectric project providing 10 mW of dependable capacity. The project requires a 3,048 m long penstock and tunnel to capture the head and flow between two existing reservoirs. Because the topography did not permit siting of an economical surge tank, the pressure and speed rise are controlled with a synchronous poly-jet pressure regulator valve. (Rochester-PTT)
W86-04727

DEVELOPING SMALL HYDRO IN INDIA,
Teknow Consultants and Engineers Pvt. Ltd., New Delhi (India).
D. R. Sikka.
Water Power and Dam Construction, Vol. 38, No. 2, p 59-60, April 1986.

Descriptors: *Small hydro, *Micro hydro, Mini hydro, *India, *Hydroelectric power, Electric power production, Management planning, Canal drops, Irrigation, Agriculture, Rural industries, Developing countries.

The potential role of small hydro in India and the problems delaying small hydro application are discussed. Small hydro in India consists of 83 stations producing 140 MW, with 43 stations under construction accounting for a total capacity of 120 MW, and 100 schemes under consideration with a potential 320 MW. About 230 micro/mini hydro stations have been constructed since 1897, and account for 45 MW. Serious delays occur in design, model experiments and manufacturing, and in matching civil works and coordinating with manufacturers. The total potential from small hydro projects is 6,000 MW, of which 1,000 MW is from irrigation canal crops. Micro hydro energy systems can be used in rural areas to augment the supply of energy for agriculture and rural industries. (Rochester-PTT)
W86-04728

CROSS SOLENT WATERMAIN,
Southern Water Authority, St. Leonards (England).
For primary bibliographic entry see Field 5F.
W86-04753

INSTALLATION AND OPERATION OF A BUBBLE GAUGE NETWORK IN THE MAHAKAM RIVER BASIN, EAST KALIMANTAN, INDONESIA,
German Agency for Technical Cooperation, Frankfurt am Main (Germany, F.R.).
For primary bibliographic entry see Field 7B.
W86-04800

EXPERIENCES GAINED DURING THE HYDRAULIC INVESTIGATIONS ON THE COOLING WATER SYSTEM OF A THERMAL POWER STATION,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
J. Tas, and P. Schneemeier.
IN: Advances in Hydrometry, IAHS Publication No. 134, 1982. Proceedings of a Symposium at the First Scientific General Assembly of the IAHS, July 19-30, 1982, Exeter, England. p 203-213, 5 fig, 1 tab.

Descriptors: *Flow measurement, *Ultrasonics, *Flowmeters, *Current meters, *Flow discharge, Hydrometry, Gages, Hydraulic equipment, Cooling water, Thermal powerplants, Discharge measurement.

Occasional flow measurements with conventional current meters are often too time- and labor-consuming to be practicable for field investigations on the water systems of large industrial and agricultural consumers. Measurements under extreme conditions departing from normal operation are especially difficult. These measurements conflict with the interests of operation, but are essential for plotting performance curves. In such cases the ultrasonic method of flow measurement can be applied to advantage and with acceptable accuracy. Under adverse conditions of installation the integrating type of ultrasonic measurement proved successful. (See also W86-04785) (Author's abstract)
W86-04803

SUBMERSIBLE PROPELLER PUMP AS AN ALTERNATIVE TO THE TUBULAR AXIAL FLOW PUMP,
Werk Bremen (Germany, F.R.). Water Pumps Div.
H. Knopp.
Water Services, Vol, 90, No. 1080, p 55-56, 59, February 1986. 9 fig.

Descriptors: *Pumps, *Drainage, *Effluents, Submersible propeller pump, Tubular axial flow pump, Hydraulic equipment, Leakage.

The combination of the classical tubular axial flow pump for drainage and the standard submersible pump for discharging effluent has resulted in the submersible propeller pump. With the reliable hydraulics of the propellar tubular axial flow pump and the proven combination of the dry running asynchronous motor with the double mechanical seal the submersible motor propeller pump is an alternative to the tubular axial flow pump. Depending on plant conditions the choice of one type or the other can only be determined by an evaluation of the technical and industrial advantages and disadvantages by the user/planner of the plant together with the pump supplier. The submersible propeller pump, type PNT, consists of three units: motor, cables with cable glands, and pump section. The sealing combination is important. Two single acting mechanical seals with rubber bellows in tandem guarantee the lowest leakage rates. The bearing with the mechanical seals is placed near the impeller which has a small shaft diameter. The leakage rate and/or the wear is dependent on the circumferential speed and thus on the diameter of the sealing surfaces and the radial bearing. Some advantages of the submersible propeller pumps include relatively low noise level, lighter weight than a comparable tubular axial flow pump, no above surface structure, easily moved, and the intake structure can be smaller than that of a tubular axial flow pump with an air cooled motor because of the well cooled motor surface of the submersible propeller pump. (Peters-PTT)
W86-04986

SEAWATER PUMPED-STORAGE SCHEME UNDER STUDY IN JAPAN,
Electric Power Development Co. Ltd., Tokyo (Japan). Construction and Engineering Dept.
T. Hashimoto.
Water Power and Dam Construction, Vol. 38, No. 2, p 9-11, February 1986. 2 fig.

Descriptors: *Pumped storage, *Artificial lakes, *Japan, *Hydroelectric plants, *Fouling, *Sealants, *Breakwaters, Okinawa, Marine organisms, Reservoir, Environmental studies, Turbidity, Wave dissipation.

Current investigations and research being conducted for a seawater pumped-storage scheme in Okinawa, Japan, are outlined. The scheme calls for generation of a maximum output of 150 MW (3 x 50 MW units) as a source of peak power supply, and includes an excavated upper pond. The problem of sea-water seepage, marine fouling, and preliminary environmental investigations are discussed. Main features of the design include: (1) choice of an excavated type of pond, so that the site could be selected to keep the waterway as short as possible and to eliminate the need for a spillway; (2) watertightness of the pond is achieved using waterproof sheets (ethylene propylene terpolymer rubber tested best) and a drainage layer behind the sheets to collect any seepage for pumping back into the pond; (3) maintaining high flow velocity in the waterway to prevent adherence of marine organisms; and (4) introduction of breakwaters and wave dissipation works to avoid turbidity in the tailrace area (and the intake while pumping). (Rochester-PTT)
W86-04995

BATH COUNTY: THE WORLD'S LARGEST PUMPED-STORAGE PLANT COMMISSIONED,
Virginia Power, Warm Springs.
R. Sullenberger.
Water Power and Dam Construction, Vol. 38, No. 2, p 12-13, February 1986. 2 fig.

Descriptors: *Pumped storage, *Virginia, *Bath county, *Hydroelectric plants, *Construction, Dam construction, Tunnel construction, Reservoir construction, Penstocks, Turbines, Peaking power, Scheduling, Powerplants.

Construction of the 1.65 billion dollar Bath County, Virginia, pumped-storage plant is reviewed. The plant began commercial operation in December 1985. It adds 2,100 MW of peaking power to a six-state service area. The main features of Bath County include the 500 x 200 x 150 ft powerhouse, two earth- and rock-filled dams containing 22 million cu yd of material, and about 12 miles of tunnels. Although the powerhouse is above ground, it will experience the greatest submergence of any structure of its type, because of a fluctuation of 60 ft in water depth of the lower reservoir. Seepage into the structure has been insignificant during the first full reservoir filling. There are six Francis-type pump-turbine generator motor units, rated at 350 MW each, and operating at a maximum head of 1,262 ft. Particular construction difficulties were encountered due to penstock rupture, in welding of spiral casings, and due to leakage of one penstock lining, which required drilling and grouting involving injection of about 90,000 bags of cement. Civil structure areas and dams were constructed ahead of schedule; during this phase a world record was set in continuous underground jumpform pumping. (Rochester-PTT)
W86-04996

SCALE MODEL TESTS FOR AUSTRIA'S KUHTAI PUMPED-STORAGE PLANT,
Technische Univ., Graz (Austria). Dept. of Hydromechanics, Hydraulics and Hydrology.
H. Simmler, and E. Kresnik.
Water Power and Dam Construction, Vol. 38, No. 2, p 14-16, February 1986. 9 fig, 6 ref.

Descriptors: *Hydroelectric plants, *Pumped storage, *Austria, *Hydraulic models, *Hydraulic engineering, Kuhtai pumped storage plant, Scale model tests, Powerhouse intake, Outlet structure, Vortices, Approach flow, Pumping, Uniform flow, Powerplants.

The history and present status of pumped-storage in Austria, and its relationship to the country's topography and hydrology are outlined, followed by a description of the results of hydraulic scale model testing for the design of the powerhouse intake and outlet structure for the Kuhtai pumped-storage scheme. Hydraulic scale model tests were conducted to ensure that two essential requirements were met, namely: (1) establishing an approach flow free of air-entraining vortices, that is, an air-free and low-vorticity flow, to the intake structure, and (2) establishing a uniform and irrotational approach flow from the draft tube. Theoretical concepts and results of the tests are described for the vortex problem (pumping mode) and flow conditions in the pressure shaft (pumping mode). It is concluded that for pump intakes, and for inlets in general, where the formation of strong vortices or even air-entraining vortices is to be avoided, a theoretical approach will rarely be reliable enough in view of the complexity of the marginal conditions that govern flow. The same applies where a smooth and uniform approach flow to the draft tube inlets is to be established. Scale model tests help to devise means of preventing efficiency losses or disturbances during operation. (Rochester-PTT)
W86-04997

CONSTRUCTION OF CZECHOSLOVAKIA'S DLOUHE STRANE PROJECT,
Hydroprojekt, Brno (Czechoslovakia).
M. Janda.
Water Power and Dam Construction, Vol. 38, No. 2, p 23-26, February 1986. 3 fig, 2 tab.

Descriptors: *Pumped storage, *Dlouhe strane, *Czechoslovakia, *Peaking capacity, Construction, Design, Tunnels, Pump-turbines, Automation, Ostrava, Moravia, Hydroelectric plants, Powerplants, Desna River.

The role of pumped-storage in Czechoslavakia is reviewed, and details of the design and construction to date of the 650 MW Dlouhe Strane project are described. Dlouhe Strane is sited in northern Moravia, where favorable geomorphologic conditions were found. The upper reservoir is at 1,350

m, and the lower one is in a deep valley of the Desna River. Two tunnels of 3,600 mm diameter will connect the hydro plant with the upper reservoir. An underground machine hall is the main structure of the scheme; the cavern is 25 m wide, 50 m high, and 87 m long. Two reversible Francis pump-turbines, each with a maximum output of 325 MW and a pumping output of 312 MW, will be used. After commissioning, the pumped-storage plant will serve not only during peaks in the daily and weekly loading schedules, but for standby in cases of losses in the distribution system. Operation of the power station will be fully automated, primarily between the pumping unit and the turbine. A major advantage of the station is its proximity to the Ostrava industrial region. (Rochester-PTT)
W86-04998

ELECTRO-MECHANICAL EQUIPMENT FOR THE KALAYAAN PUMPED-STORAGE PLANT,
Gruppo Industrie Elettromeccaniche per Impianti all'Estero, Milan (Italy).
F. di Gioia.
Water Power and Dam Construction, Vol. 38, No. 2, p 33-36, February 1986. 5 fig.

Descriptors: *Kalayaan, *Phillipines, *Pump-turbines, *Hydroelectric plants, *Pumped storage, Pumping, Electric power production, Powerplants.

Characteristics are described for the first two single-stage reversible pump-turbine units, each rated at 150 MW, recently completed at the Kalayaan pumped storage plant in the Phillipines. These include the power station, electro-mechanical equipment (upper and lower intakes, penstock, spherical valves, pump-turbines, motor-generators, and step-up transformers), electrical and electronic equipment (control room, service building, control building, and switchyard), and pump starting methods. The project takes advantage of two existing reservoirs and when the remaining units are in place it will have a rated capacity of 1,800 MW. Pump starting is accomplished by three different sequences: a pony with the runner in air (normal sequence); back-to-back (one unit only) with the runner in air, using about 4 MW power from the other unit; and back-to-back (one unit only) with the runner in water and the spherical valve closed, using about 35 MW from the other unit. The distinctive feature of the Kalaayan plant is its flexibility of operation because of its rapid connection to the network, which includes geothermal and thermoelectric stations, and because of its wide range of operational modes. (Rochester-PTT)
W86-04999

CONSTRUCTION OF SPAIN'S CORTES-LA MUELA SCHEME,
Hidroelectrica Espanola, Madrid.
N. Nevalon.
Water Power and Dam Construction, Vol. 38, No. 2, p 37-41, February 1986. 6 fig.

Descriptors: *Hydroelectric plants, *Spain, *Cortes dam, *La Muela, *Pumped storage, *El Naranjero dam, *Reservoirs, Geology, Nuclear powerplants, Cost analysis, Intakes, Conduits, Tunnels, Powerplants.

The Cortes-La Muela project, currently under construction, will provide 870 MW of peak power for East Spain, while complementing, with 540 MW of pumping capacity, the operation of a nearby nuclear plant. The main project features two dams, two powerplants, and an artificial reservoir. The two powerplants are linked hydraulically through the reservoir created by Cortes dam, and electrically connected by a single switchyard that allows the direct coupling of the units for back-to-back start-up. Cortes II is a conventional hydroelectric plant the downstream reservoir of which, El Naranjero, is used for flow regulation, whereas La Muela is a pure pumped-storage plant. The total cost of the project will be about 750 million dollars, including interest during construction and price escalation. Commissioning of the Cortes II machinery is scheduled for mid-1988, whereas the units at La Muela will begin operation in the first half of 1989. Exploration work, geology, Cortes dam and reservoir, Cortes II powerhouse, El naranjero dam and reservoir, La Muela upper reservoir, water intakes and conduits, powerhouse and transformer caverns, and project status are described. (Rochester-PTT)
W86-05000

CHINA'S FIRST WORLD BANK-ASSISTED HYDRO SCHEME,
Ministry of Water Resources and Electric Power, Beijing (China).
C. Xuemin.
Water Power and Dam Construction, Vol. 38, No. 2, p 41-44, February 1986. 2 fig.

Descriptors: *Hydroelectric plants, *China, *Lubuge hydropower project, *World Bank, *Contracts, *Bids, Project management, Japan, Norway, Australia, Germany, Turbines, Generators, Powerhouse, Headworks, Hydraulic system, Rockfill dams, Consultants.

Project layout, headworks, hydraulic system, powerhouse complex, and contracting and financing arrangements are described for the Lubuge hydropower project on the Huangni River, China. This project, with a design capacity of 600 MW, is the first hydro project to be financed with a World Bank loan. It will comprise a 101 m-high rockfill dam, a 9 km-long power tunnel with an underground powerhouse, and is scheduled for completion in 1988. The contracting and bidding practices employed on this project followed international competitive bidding practice, which differed significantly from the methods used by the Chinese government in building more than 100 major hydro stations and 80,000 small hydro plants since 1949. An Australian consultant reviewed the design and cost estimate, a Japanese contractor received the contract to build the hydraulic system, a Chinese construction force works on the headworks and powerhouse complexes, and turbine from Norway and generators from Germany are being used. Some difficulties were encountered, but the success and merits of using foreign consultants have been acknowledged by people at various levels in China. (Rochester-PTT)
W86-05001

TECHNIQUES FOR SOVIET PUMPED-STORAGE PLANT CONSTRUCTION,
Vsesoyuznyi Gidroproektno-Izyskatel'skii i Nauchno-Issledovatel'skii Inst. 'Gidroproekt', Moscow (USSR).
L. P. Mikhailov.
Water Power and Dam Construction, Vol. 38, No. 3, p 20-23, March 1986. 10 fig, 2 ref.

Descriptors: *Pumped storage, *USSR, *Dam construction, *Hydroelectric plants, Concrete, Hydraulic engineering, Design, Conduits, Dikes, Cost analysis, Economies of scale, Powerplants.

The standardized approach to production of pumped-storage plants as carried out in the USSR is described. At present there are 11,700 MW of aggregate capacity under construction. For projects of similar construction geology and heads around 100 m it has been found practical to standardize the main structures to accommodate mass-produced 200 MW units designed for that head. Standardization of designs for pumped-storage stations leads to economies of scale and cuts the cost of design and engineering work. Reinforced concrete structures of powerhouses, water intake/outlets of the upper reservoirs, and penstocks were the first components to be standardized. Powerhouses of a conventional type are designed as a continuous structure that is divided into sections: central, standard, and side sections adjoining the abutments. The powerhouse construction is fully standardized below the level of the machine hall floor, with variations above this level adopted depending on the water level variation in the lower reservoir. One of the main standardized structures is the water conduit, with inner diameter of 7.5 m, maximum water static pressure of 1.23 MPa, and maximum dynamic pressure of 1.71 MPa. Conduit joints, concrete handling procedures, and dike protection measures also are described. (Rochester-PTT)
W86-05003

TIDAL POWER ENGINEERING IN THE USSR,
Vsesoyuznyi Gidroproektno-Izyskatel'skii i Nauchno-Isaledovatel'skii Inst. 'Gidroproekt', Moscow (USSR).
For primary bibliographic entry see Field 8A.
W86-05005

OPTIMUM CAPACITY AND TUNNEL DIAMETER OF RUN-OF-RIVER PLANTS,
Morrison-Knudsen Engineers, Inc., San Francisco, CA.
For primary bibliographic entry see Field 8A.
W86-05007

HYDRO PLANT FREQUENCY REGULATION,
Motor-Columbus Ingenieurunternehmung A.G., Baden (Switzerland).
F. de Leva.
Water Power and Dam Construction, Vol. 38, No. 5, p 27-31, May 1986. 15 fig, 4 ref.

Descriptors: *Penstock, *Electric equipment, Hydroelectric plants, *Hydraulic engineering, Networks, Powerplants.

Penstock and generator design influence the frequency response of a hydroelectric powerplant. Means are provided for estimating the values that such parameters should have as a function of the desired quality of the frequency regulation. The behavior of a powerplant was simulated when a sudden load decrease occurs; the plant operates on an isolated network with resistive loads only. Although these assumptions are restrictive and the conditions described do not normally occur, the results are useful in cases of parallel operation of a plant with other units because comparative criteria can be established for the determination of the frequency regulation quality of a powerplant. Furthermore, the method presented also permits determination of the effects that changes in penstock and generator parameters have on the capacity to respond to load variation. Of primary importance to the quality of frequency regulation is the penstock inertia constant, which is defined as penstock length x steady-state flow/gravity acceleration x steady-state head x permanent penstock area. This parameter should be kept as low as possible because when its value is high, an increase in generator inertia has only a limited effect on improving the quality of frequency regulation. The value of the penstock inertia constant may be decreased by shortening the penstock or increasing its diameter to lower the water velocity. (Rochester-PTT)
W86-05009

PLATE SEPARATION - BUDDING CONVENTIONAL TECHNOLOGY,
Aqua Trend, Inc., Shawnee Mission, KS.
For primary bibliographic entry see Field 5D.
W86-05011

PUBLIC RELATIONS PLOYS HAVE TRANSFORMED REGULATORY ISSUE INTO CONSUMER CONCERN,
For primary bibliographic entry see Field 6E.
W86-05058

SMALL ASYNCHRONOUS HYDROGENERATORS AND THEIR CONTRIBUTION TO ENERGY RECOVERY IN THE WATER INDUSTRY,
Severn-Trent Water Authority (England). Soar Div.
G. H. Thorp.
Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 4, p 301-314, August 1985. 5 fig, 2 tab.

Descriptors: *Hydrogenerators, *Hydroelectric power, *Energy recovery, *Reservoirs, Hydraulic turbines, Turbines, Financial feasibility, Hydraulic properties, Electric power production, Electrical equipment.

Group 8C—Hydraulic Machinery

The basic requirements for the optimization of hydrogenerator system performance are outlined with consideration of financial viability. The design, installation, and commissioning of a Hayward Ryler asynchronous submersible hydrogenerator at Gilroes reservoir is recounted and its effective contribution to energy recovery discussed. The energy recovery system is based on an average inflow to the reservoir of 162 L/sec which, allowing for an estimated recovery efficiency of 65%, gives an average energy recovery of 33 KW of usable electricity. After 6 mo. of operation the hydrogenerator system has proved to be practical. The use of solid state devices where possible has minimized the cost of the ancillary devices needed to operate the turbine. It is concluded that small hydrogenerators like the one installed at Gilroes are practical and, if reliable, are a cost effective contribution to energy recovery. (Peters-PTT)
W86-05077

SIMPLICITY IS MARK OF PUMP STATION IN THE ROUND,
W. Stevens, and W. Williams.
Water/Engineering & Management, Vol. 133, No. 4, p 21-22, 24-25, April 1986.

Descriptors: *Pumping plants, *Houston, *Sewer systems, *Wastewater facilities, Cylindrical lift station, Maintenance, Hydraulic equipment.

A pumping station, now in an advanced construction stage in Houston, TX, will become a key part of Houston's huge Northside wastewater project. The cylindrical configuration, of the 370 mgd facility, produces significant construction advantages. The cylindrical geometry permitted the entire facility to fit into the confines of a restricted site bounded by railroad rights of way and a major road. It also made it favorable to employ sunken caisson construction, which provided substantial economies. The peripheral wall is 66 ft in diameter while the interior wall, forming a central core, has an inner diameter of 34 ft. Entering the structure through a 132 inch diameter sewer line, the influent will pass to the central core which acts as a surge tank to dampen turbulence. The influent chamber is located at the base of the central core, and has an inlet structure 67 feet below grade. Its floor slopes from the center toward the central core wall. The effluent chamber is located within the central core, approximately 40 feet above the influent chamber liquid level. Effluent discharges directly from it into a 132 inch sewer, with its invert at the same elevation as the effluent chamber floor. The floor has a 2% slope toward the sewer for drainage. The submersible pumps ride on vertical guide bars and can be readily hoisted out of wet well without the need for fastening or unfastening. Liquid level is controlled by the number of pumps operating. Each rise or fall of 9 inches in liquid level is sensed by a bubble system and causes one pump to be turned on or off. The station will operate unmanned. (Peters-PTT)
W86-05120

AUTOMATIC THROTTLE HOSE - NEW FLOW REGULATOR,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
For primary bibliographic entry see Field 3F.
W86-05237

APPLICATION OF FUNCTIONAL ANALYSIS TO OPTIMIZATION OF A VARIABLE HEAD MULTIRESERVOIR POWER SYSTEM FOR LONG-TERM REGULATION,
Ain Shams Univ., Cairo (Egypt). Faculty of Engineering.
S. A. Soliman, and G. S. Christensen.
Water Resources Research WRERAO, Vol. 22, No. 6, p 852-858, June 1986. 1 fig, 7 tab, 10 ref. National Research Council of Canada Grant A4146.

Descriptors: *Functional analysis, *Varied flow, *Power head, *Reservoirs, *Hydroelectric power, *Long-term planning, Regulations, Mathematical analysis, Multi-purpose reservoirs, Water supply, Rivers, Stochastic hydrology.

Functional analysis and minimum norm formulation are employed to solve the optimal long-term problem of a hydro power system for maximum total expected benefits (benefits from energy generated by a hydro power system over the planning period plus the expected future returns from water left in storage at the end of that period). The method proposed in this paper has the ability to deal with large scale coupled power systems. Most of the current approaches use composite reservoirs. The proposed method takes into account the water head variation and the stochasticity of the water inflows. It is assumed that their probability properties are preestimated from past history. The expected value for these random inflows is used. Numerical results are presented for a real system in operation including up to six reservoirs for widely different water conditions. The computing time to get the optimal solution for this, using the proposed approach, was very small compared to the computing time using other techniques such as the Aggregation/Decomposition approach. (Lantz-PTT)
W86-05242

SOME DEVELOPMENTS IN PRESSURE REDUCTION,
Bristol Waterworks Co. (England).
S. G. Bessey.
Journal of the Institution of Water Engineers and Scientists, Vol. 39, No. 6, p 501-506, December 1985. 2 fig, 1 tab, 3 ref.

Descriptors: *Leakage, *Water pressure, *Hydraulic equipment, Pressure distribution, Process control, Automation, Computer, Flow, Pumpage.

The Bristol Waterworks Company has utilized a microprocessor-based telemetry system of flow compensated pressure reduction since 1976. The company has found several economic limitations to the application of the computer-controlled pressure reducing valve and has pioneered the development of a hydraulically operated alternative for smaller zones. The hydraulic flow compensating pressure reducing valve (PRV) uses an orifice plate bolted to a standard PRV to sense flow rate. At higher flows, the high pressure differential across the orifice plate is transferred to the relay unit which causes the valve to open, delivering a higher outlet pressure. Remote users are more easily accommodated in a segmented large zone under several hydraulic valves due to the shorter distance involved and the ability to set each valve individually. The company's first conversion of a small induction motor-pumpset to variable-speed drive resulted in a reduction of energy use of 23% and in pumped quantity of 14%. The company is currently assessing the conversion of a fixed-speed autopneumatic station to variable-speed duty with flow compensation. (Geiger-PTT)
W86-05318

SUBMERSIBLE PUMPS HELP IMPROVE WATER SUPPLY FROM DEEP LIMESTONE WELL,
Bluffton Electrical and Water Utilities Dept., IN.
E. C. Davis.
Public Works, Vol. 117, No. 2, p 58-59, February 1986. 1 fig.

Descriptors: *Pumps, *Pumping, *Wells, *Pump wells, Pumping tests, Pumpage, Pump testing, Deep wells, Water supply.

An additional 144,000 gallons of pumpage per day was made possible at the Bluffton waterworks after well cleaning, providing a deeper setting of the submersible pumping unit, and modifying the standard submersible system and its installation. An air-control type of relief valve used in the discharge pipe prevented too-rapid air discharge at start-up and joint locking compound was applied to each of the threaded column pipe points to prevent unscrewing of the pump column due to starting torque. Pump and motor construction were of materials to resist chemical attack, and the pump was supplied with sufficiently large pump impeller passages to permit handling of small slugs during the cleaning process. Following well cleaning, a two-stage Ni-Resist pump with 8-inch bowls driven by a 2-pole, 6-inch, 40-hp Franklin submersible motor with Ni-Resist construction was installed. The success of the present experiment seems to have implications for the rejuvenation of wells of similar kind. (Geiger-PTT)
W86-05320

8D. Soil Mechanics

ANALYSIS OF STRATIGRAPHIC CONTROL ON RIVER BANK FAILURE,
Nigeria Univ., Nsukka. Dept. of Geology.
For primary bibliographic entry see Field 4D.
W86-04748

INTEGRATED DEBRIS FLOW OBSERVATIONS,
Kyoto Univ. (Japan). Disaster Prevention Research Inst.
For primary bibliographic entry see Field 2J.
W86-04868

WORLD'S HIGHEST DAM CONQUERS HARSH ENVIRONMENT,
Vsesoyuznyi Gidroproektno-Izyskatel'skii i Nauchno-Issledovatel'skii Inst. 'Gidroproekt', Moscow (USSR).
I. Moiseev.
Water Power and Dam Construction, Vol. 38, No. 3, p 17-19, March 1986. 3 fig, 2 tab.

Descriptors: *Rogun dam, *Tadjik SSR, *Precipitation, *Snow, *Cold weather construction, *Dam construction, *Earth dams, *Rockfill dams, *Earthquake engineering, Hydroelectric plants, Tunnels, Gates, Permeability, Pore pressure, Soil water, Powerplant.

The main characteristics and special features of the 335 m-high Rogun earth- and rock-fill dam project in the Tadjik SSR are described. When complete the installed capacity will be 3,600 MW and the dam will be the highest in the world. The temperature at the site ranges from a maximum of 40 C to a minimum of -31 C, with annual precipitation reaching 816 mm, and with an average depth of snowfall in winter of 61 cm. The construction site is also in a zone of high seismic and tectonic activity. Among the noteworthy construction techniques are continuous cycle technique of dam construction, which calls for the combined use of vehicles and conveyer systems at the borrow area and at the dam. Other unusual design solutions include: the integration of discharge tunnels at the service outlet works with the surface and lower-level intakes, making one outlet system; the use of the end portions of the diversion tunnels as a tailrace tunnel; the use of the main gates in the diversion tunnels, designed for a head of up to 200 m; the use of the crane track supports in the gate chambers of the outlet works without the crane runway columns; and the use of cast concrete to fill the space behind the lining of the penstocks. The grade IX seismicity of the region dictated special measures to ensure dam stability, including: filling external dam zones with graded rock with a permeability coefficient of not less than 0.001 cm/sec; compaction of the material in the shells to an extent that prevents the development of dynamic pore pressure in the upstream shell in the event of subsidence deformation; and lower shearing strength characteristics of the soil material in the dam are adopted in the seismic impact stability analysis. (Rochester-PTT)
W86-05002

8E. Rock Mechanics and Geology

EVALUATION OF ELECTRICAL RESISTIVITY METHODS IN THE INVESTIGATION OF KARSTIC FEATURES, EL CAJON DAM SITE, HONDURAS,
Florida Univ., Gainesville. Dept. of Geology.
D. L. Smith, and A. F. Randazzo.
Engineering Geology, Vol. 22, No. 3, p 217-230, April 1986. 12 fig, 7 ref.

Descriptors: *Electrical resistivity, *Karst, *El Cajon Dam, *Honduras *Electrode arrays, *Faulting, *Fracture Zones, *Dissolution features, *Damsites, *Dam construction, Wenner array, Schlumberger array, Bristow array, Pole-Dipole array, Cost analysis, Field tests, Humuya River.

Wenner electrode array, Schlumberger array, and Bristow (pole-dipole) array configurations of electrical resistivity measurements were used to detect the presence of subsurface dissolution features at the El Cajon dam site in Honduras. The construction site, located on the Humuya River in a region of extensive karst development, faulting, and mineralization along fracture zones, posed a special challenge to the application of standard resistivity techniques because of the presence of a cofferdam and the advanced stage of construction. Transects were made parallel and perpendicular to the river valley floor. The best results were obtained with the Schlumberger and Bristow array configurations. Several zones of anomalously high resistivity were detected. Subsequent drilling confirmed the presence of subsurface dissolution features that could have seriously jeopardized the dam. These surveys represent an accurate, economic, and reliable procedure for regions where construction has progressed significantly and where complex geologic terrain exists. (Author's abstract-PTT)
W86-04747

DESIGN OF PERVIOUS PRESSURE TUNNELS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
For primary bibliographic entry see Field 8A.
W86-05008

ON-SITE ASSESSMENT OF ROCK DISCONTINUITIES FROM RESISTIVITY LOGS. T-L LOG: A NEW LOGGING TECHNIQUE,
Imperial Coll. of Science and Technology, London (England). Div. of Engineering Geology.
G.-A. Tselentis.
Journal of Hydrology, Vol. 83, No. 3/4 p 269-283, March 1986. 1 tab, 12 fig, 5 ref.

Descriptors: *Rocks, *Resistivity, *On-site investigations, Discontinuities, Computers, Hydraulic properties, Fractures, Geophysical parameters, Rock properties.

The extent to which the discontinuities of a fractured formation can be assessed from parameters inferred from normal resistivity logs was examined. Using a microcomputer in series with the logging unit, a zonation process was applied to the logs, which were interpreted in terms of a series of beds, each having specific thickness and resistivity, and a new parameter defined by the difference between transverse and longitudinal resistivities was computed (T-L log). In almost all the cases in which the method was applied, the results were satisfactory and the microcomputer-based software and hardware package that was developed for the automatic processing of the data was very efficient. The logs were processed directly in the field by an ACORN-ATOM 8-bit, 32K microcomputer, and all the software necessary for data processing were kept in an EPROM Module. (Peters-PTT)
W86-05113

8F. Concrete

LARGE CONCRETE DAM CONSTRUCTION IN THE USSR,
Vsesoyuznyi Gidroproektno-Izyskatel'skii i Nauchno-Issledovatel'skii Inst. 'Gidroproekt', Moscow (USSR).
For primary bibliographic entry see Field 8A.
W86-05004

8G. Materials

EVALUATION OF ELECTRICAL RESISTIVITY METHODS IN THE INVESTIGATION OF KARSTIC FEATURES, EL CAJON DAM SITE, HONDURAS,
Florida Univ., Gainesville. Dept. of Geology.
For primary bibliographic entry see Field 8E.
W86-04747

PLASTIC LINING ON RIVERTON UNIT, WYOMING,
R. W. Wilkinson.
Journal of Irrigation and Drainage Engineering JIDEDH, Vol. 111, No. 3, p 287-298, September 1985. 6 fig, 4 tab, 7 ref.

Descriptors: *Plastics, *Linings, *Riverton Unit, *Wyoming, Water conveyance, Polyvinyl-chloride, Irrigation engineering, Costs, Design standards, Construction, On-site investigations.

Since 1975, the Bureau of Reclamation has installed approximately 25.8 miles (41.5 km) of PVC (polyvinyl-chloride) lining in the distribution system of the Riverton Irrigation Project. The lining is part of a $40,000,000 rehabilitation program designed to stop waterlogging of adjacent farmland and conserve water. This paper describes this project through discussions covering: site investigations and surveys, design, specifications, construction, lining performance, and costs. The PVC sections have performed well. In the few occasions when the lining slid down the side slope, the slippage occurred either downstream of drop structures, or immediately upstream of inlet transitions for in-line structures. Final costs of 23 contracts involving the PVC lining are tabulated. (Peters-PTT)
W86-05240

8I. Fisheries Engineering

INNOVATIVE DESIGN OVERCOMES MULTIPLE INSTITUTIONAL BARRIERS AT HYDRO PLANT,
For primary bibliographic entry see Field 8C.
W86-04682

RIVER BASINS,
Food and Agriculture Organization of the United Nations, Rome (Italy).
R. L. Welcomme.
Available from the FAO, Via delle Terme di Caracalla, 001000 Rome, Italy. Price: $7.50. FAO Fisheries Technical Paper 202, 1983. 60 p, 22 fig, 3 tab, 40 ref.

Descriptors: *River basins, *Fisheries, *Fish populations, *Fish management, *Fishing gear, Fish, Ecology, Fishing, Fish stocking, Water resources development, Erosion, Hydraulic structures, Water quality, Aquaculture, Fish farming.

Rivers may be divided into fast-flowing, upland reaches and slow-flowing, lowland reaches. The ecology of a river depends to a great extent on its flood regime. Fish are highly adapted to these seasonally repetitive events. Lowland reaches of rivers usually support fisheries of exceptional value. Capture methods vary with seasonal changes occurring in the fish communities. In general, there are three main levels at which fish stocks may be evaluated. The first consists of using rapid methods for the approximate evaluation of fish stocks based on extrapolation from other similar river systems. The second consists of the evaluation of the fishery through frame surveys and catch assessment surveys. The third level consists of more traditional methods for assessment of the stocks by experimental fishing. Changes in the quality of water through pollution causes a direct effect on fish, whereas other processes such as sedimentation and the presence of hydraulic structures may indirectly affect fish populations. Management techniques to compensate for the effect of these changes included the careful control fo the fishery within the natural environment as well as the abiotic factors which affect the aquatic system. (Geiger - PTT)
W86-04816

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